POPULAR SCIENCE Monthly

Nov. 1949

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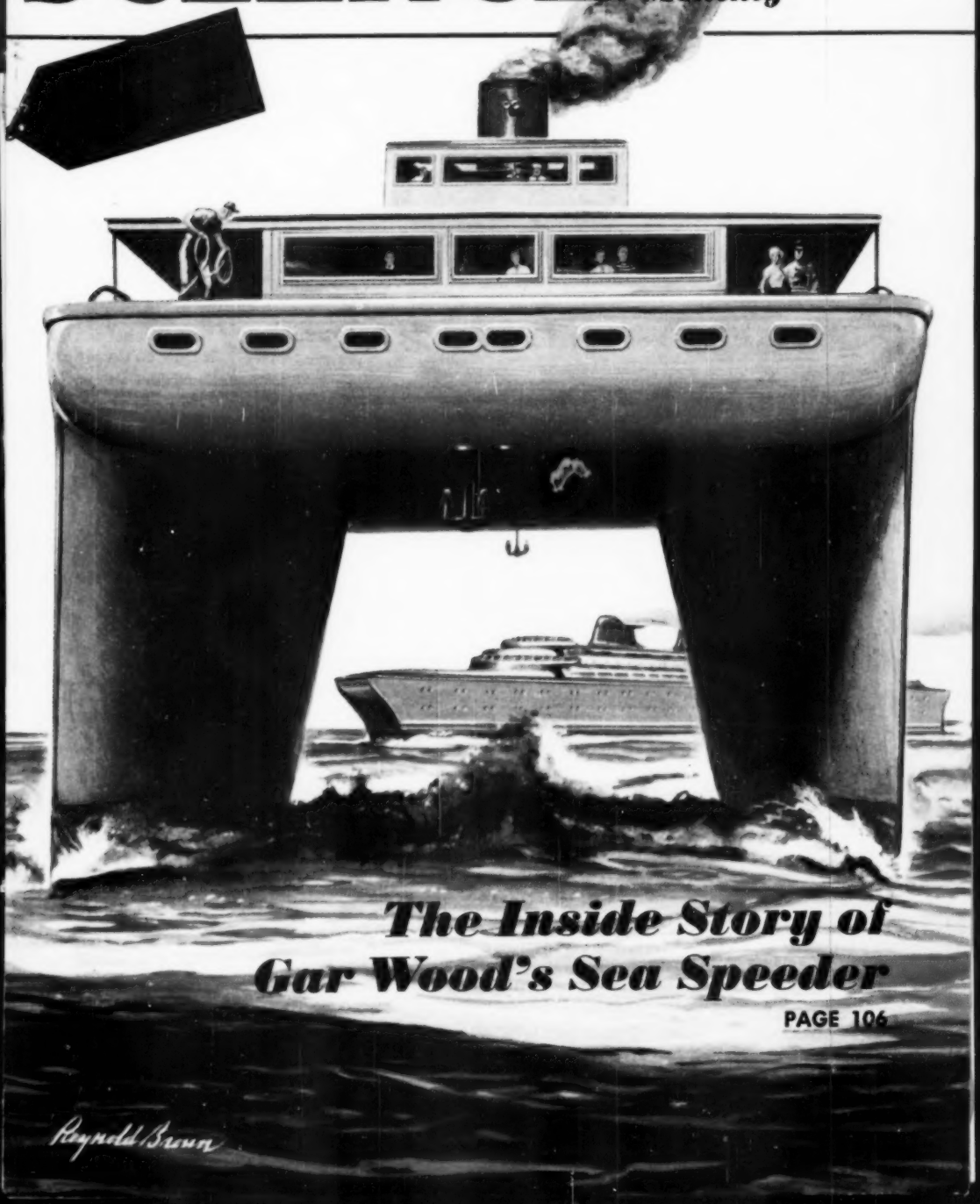

The Inside Story of Gar Wood's Sea Speeder

PAGE 106

IT'S FUN TO BE YOUR

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THIS amazingly comprehensive volume shows you how to do yourself all of the jobs around the house that have long needed doing—and a lot more you've *wished* could be done. In 8-Books-Bound-as-One, pictures and words show you how to make your own repairs on your Plumbing, Wiring, Carpentry, Electrical Appliances, Masonry, Plaster, Heating System, Furniture, etc., also how to *make valuable improvements* in your home, from a new closet to a whole new roof—from a new floor to a whole new modern kitchen.

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Beams and Floor Joists
Building Materials
Types of Lumber
Roofing Materials—Asphalt, Asbestos, Aluminum, Wood Shingles
Concrete forms, mixing
How to Make All Types of Tinsmith Repairs

INTERIOR REPAIRS

Repairing Creaky Floors
Repairing and Storing Screens
Repairing Windows—sash cord, windowpanes; loosening stuck windows
Linoleum-laying, patching
Fixing Loose Tiles
Mending China, Metal Utensils
Repairing Door Locks, Hinges
Fire Fighting Equipment
Basement into Game Room
Building Partitions
Laying Hardwood Flooring, etc.

DECORATING

Wallpapering
Cleaning Wallpaper
Cleaning Painted Walls
Repairing Plaster
Scraping Floors
Refinishing Floors
Care of Carpets and Draperies

PAINTS AND PAINTING

Types of Paint Brushes
Types of Paint
Varnishes, Enamels
Lacquers, Shellac
Calcimine
Paint Thinners
Mixing Paints
Surface Preparation
Removing Paint
Painting a New Surface
Porch Floors and Steps
Painting Metal
Preparing Plaster
Fillers, Staining, etc.

(Above) A simple little trick like knotting the wire inside extension plugs can save you severe burns, blown-out fuses, and fire hazards. Protect your home and family with the advice in this book!

ELECTRICITY IN THE HOME

Approved Electrical Equipment
Home Generators
Fuse Boxes and Fuses
Appliance and Extension Cords
Replacing Fixture Sockets
Electric Motors
Home Signalling Systems
Burglar Alarms, etc.

HEATING THE HOUSE

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Coal Furnaces, Oil Burners
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Thermostats
Fuel Economy
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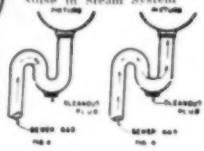
Steam Heating Systems
Cleaning, Adjusting Radiators
Noise in Steam System



(Left) You SEE diagrams that help you locate and, with little effort, fix plumbing noises, leaks, and drain stoppages.

Hot Water Heating System
Repacking Leaky Valves
Cleaning Boilers
Cleaning the Furnace
How to Insulate Your House
How to Build and Install Storm Windows
Efficient Weather Stripping, etc.

PLUMBING

Water Supply
Cause of Dirty Water
Repairing Sewage System
Cesspools, Septic Tanks
Stopped Up Sewer Pipes
Stopped Up Drains
Chemical Drain Cleaners
Plumbing Traps
Noisy Plumbing
Repairing Hot Water Tanks
Thawing Frozen Pipes
Water Softening Equipment
Repairing Faucets, Flush Tanks, Leaky Pipes, etc.

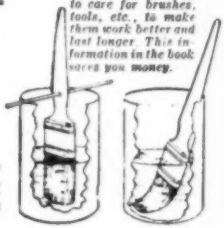
EXTERIOR REPAIRS

Waterproofing Damp Basements
Waterproofing Masonry Walls
Repairing Cracks in Foundation, Stucco Walls
Repairing Brick Walls
Repairing Leaky Roofs
Caulking Seams
Gutters and Downspouts
Ridding the House of Termites, etc.

YOUR GARDEN

Building Garden Paths
Building Garden Pool
Care and Use of Garden Tools
Cold Frames
Rustic Screens and Arches
Building an Outdoor Fireplace
Erecting Garage, Summer Guest House or Play House in Garden, etc.

Learn the correct way to care for brushes, tools, etc., to make them work better and last longer. This information in the book saves you ***money.***



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Want to convert your basement or attic into an extra apartment and give yourself a rent income that may well offset a good part or all of your taxes, mortgage payments and other expenses?

You can make these improvements yourself, at surprisingly little cost, with the help of *The Complete Home Handyman's Guide.*

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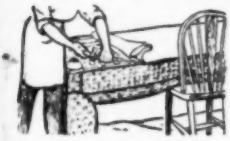
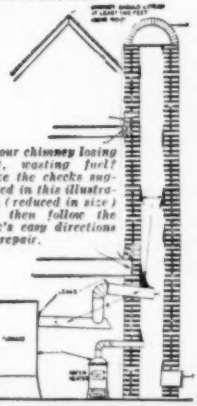


(Left) Furniture upholstery and repair is a fascinating and money-saving hobby when you follow the easy step-by-step instructions in this book.



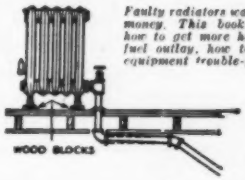
Is your chimney losing heat, wasting fuel? Make the checks suggested in this illustration (reduced in size) and then follow the book's easy directions for repair.

FURNITURE CARE AND REPAIR

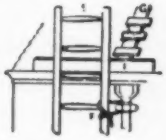
Upholstery of Chairs, Sofas, etc.
Replacing Worn Springs
Strengthening Frame
Furniture Upkeep, Cleaning, Removing Water Stains, Marks, Scratches, etc.
Loose Joints
Broken Chairs
Polishes and Polishing
Staining, etc.

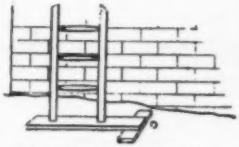
YOUR TOOL KIT

Equipping Your Workshop
Selecting the Right Tools
Correct Use of Tools
Care of Tools
How to Sharpen Tools
Sandpapers, Glues, etc.
Soldering Equipment and Technique



Faulty radiators waste heat and money. This book shows you how to get more heat for your fuel outlay, how to keep your equipment trouble-free.





Avoid hazards. This illustration shows how to secure a ladder when you make roof repairs. Complete instructions for repairing walls, foundations, gutters, shingles, etc.

How to equip a workshop, how to use all types of tools, how to use sandpaper and glues—all are fully covered in this "show-me-how" volume.

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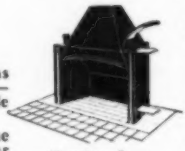
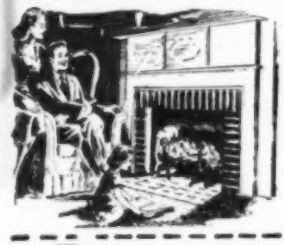
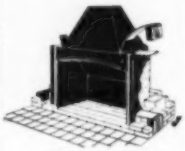


Fireplace form including firebox, damper, down draft shelf and smoke dome.





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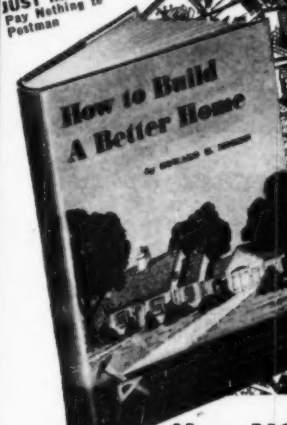

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How to Become Well-Known

Exposes the Tricks of Publicity

YOU have a RIGHT to progress, to secure a better position, to make more money, to develop talents, skills, abilities that will make you more valuable. It is up to YOU to make yourself well known to others as an individual of above-average ability. In this amazing book you will discover that people with LESS ability than you are making MORE money—*simply because they are more well-known!*

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Shows you how to become well known locally, regionally, nationally, how to achieve fame in business or profession, avocation or hobby, in industry or in organizations, in clubs or social groups, in villages and big cities. Here are case histories of success which explain how the many goals of man's activities can be reached through achievements, speeches, publicity, determined campaigning, and careful work. The author, a prominent New York publicity and public-relations counsel, has devoted twenty successful years to the job of making persons, firms, organizations and causes well known. Henry F. Woods, Jr., has written this readable, helpful, inspiring book with a knowledge gained from vast experience in this field.

How to Get Ahead in Life, Gain Reputation, Fame, Wealth

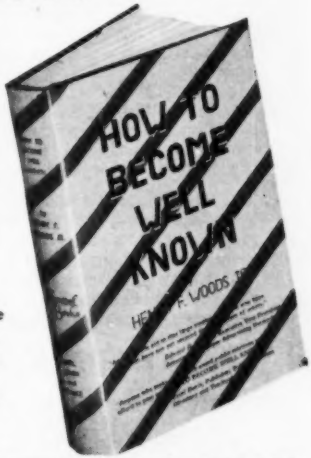
How far do you think Lincoln, Franklin, Carnegie and Henry Kaiser would have gotten without the successful publicity methods? Read their life stories for PROOF that most of their fame was due to a skillful knowledge of how to make themselves well known. You will find yourself acquiring new poise, confidence, courage. You will lose fears or inhibitions which you may now have. Great rewards lie ahead for you if you are willing to follow the easy path in "How to Become Well Known"!

How to Reach America's Millions *Without Paying For It!*

Newspapers, magazines, radio stations are HUNGRY for news about you—what you do, who you are, where and at what you work. There are THOUSANDS of ways to get free publicity. "How to Become Well Known" tells you how to take advantage of these wonderful opportunities. How to get people to talk about you. To spread your name far and wide. To build you into the kind of person you want and *ought* to be!

How to Write and Get Free Publicity For Yourself!

Mr. Woods shows you all the "ropes". How to write a news release, how to make a speech, how to address a meeting, how to be chairman of a committee. How to make friends of editors, reporters, radio announcers, columnists, your public. He cites hundreds of actual experiences in this fascinating, profitable occupation — the one means by which it is almost impossible *not* to succeed. *No stone is left unturned!*



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Here is a Sample of the Contents

IT PAYS TO BECOME WELL KNOWN
- You Know These Well-Known Persons
- How Many of Today's Average Americans Will Become Well Known?
- Why Becoming Well Known Is a Requisite to Success
- Is the Desire To Become Well Known Laudable?
- Why Being Well Known Brings Many Rewards
- How To Profit by Experience of Others

WHAT IS MEANT BY "WELL KNOWN"?
- How To Be Well Known in Business
- What Is Back of the Desire To Become Well Known?
- How Grover Whalen Became Well Known
- How To Weigh Your Own Abilities
- Self-Analysis Check List

THE MANY ROADS TO FAME
- How Accomplishments Bring Fame
- How To Widen Your Acquaintanceship
- How To Become Interested in Others
- How To Study Modern Advertisements
- Why Leaders Act in the Interest of Others
- How To Organize Groups or Associations
- Why the Well-Known Were Once Obscure

THE STARTING POINT TO FAME
- How To Work on a Committee
- Why Fame Doesn't Come Overnight
- How To Be Original in Reports
- The Opportunities To Serve
- The Value of "Big Name" Associates
- Are There Many Fields Open?
- What One Woman Accomplished

USING THE UNUSUAL TO BECOME WELL KNOWN
- You Can Do the Unusual
- How To Stand Out from the Crowd
- How To Get Clues to the Unusual
- How To Lift Things Out of the Routine
- Why There Is Little Interest in the Ordinary
- How Many Ways To Do the Unusual?

BECOMING AN EXPERT TO BECOME WELL KNOWN
- You Can Be an Expert
- Choosing a Special Field
- Why Experts Are Made—Not Born
- Why the Expert Is Practical
- How Experts Function in All Lines
- How To Become an Expert
- How Experts Started from Scratch
- Why Most Well-Known Persons Are Experts

GETTING YOURSELF OVER TO MASSES OF PEOPLE
- Communicating Information to Millions
- Why the System Is Open to All
- How To Meet the Medium's Standards
- How To Learn Through Studying Newspapers
- How To Tie in with News of the Day
- Why Study of Newspapers Has Many Advantages
- Does Radio Offer a New Field?
- Why Magazines Are High on the List
- Keeping Abreast of Periodical Literature
- Making Use of Public Libraries

BECOMING WELL KNOWN THROUGH CONFLICT
- How Conflict Helped Roosevelt
- Why Everyone Admires a Fighter
- Why Conflict Is Interesting
- How to Get in the Fight
- How to Avoid Oblivion
- Why Labor Leaders Are Well Known
- Fighting in Your Own Business
- What Are You Opposed To?
- How to Get Into a Controversy
- How Many Started the Climb

WHAT YOU SAY CAN MAKE YOU WELL KNOWN
- What Do You Say?
- How Sayings Bring Fame
- How to Study What Others Have Said
- How to Learn to Use Words
- The Use of Humorous Sayings
- How to Steer Clear of Cliches
- Where to Say It
- What's Needed to Speak Out
- Test Yourself on Words
- Define Your Words

USING THE WRITTEN WORD TO BECOME WELL KNOWN
- The Value of the Written Word
- Using Letters to Become Well Known
- How to Look for Letter-Writing Opportunities
- How to Learn to Write
- How to Use the Letter to the Editor
- Why Editors Seek Letters from Readers
- Use of Pamphlets
- Using Lists of Names

USING THE SPOKEN WORD TO BECOME WELL KNOWN
- Why the Spoken Word Is Powerful
- Becoming Prominent by Speaking
- You Can Learn to Be a Speaker
- How to Prepare Remarks in Advance
- How Research Aids the Speaker
- Using Reprints of Speeches

BECOMING WELL KNOWN THROUGH STUNTS
- What the Stunt Should Be
- How to Conceive a Stunt
- The Stunt and Showmanship
- The Leap from Showmanship to Stunts
- Why Simplicity Is Valuable
- How to Learn Value of Emotional Appeal
- The Use of Tie-ups
- Other Tie-up Opportunities

USING PUBLICITY TO BECOME WELL KNOWN
- What is Publicity?
- How Publicity Has Come Into Its Own
- Why Editors Rely on Publicity Material Today
- Why Publicity Is an Aid to Becoming Well Known
- A Definition of "News"
- How to Learn to Judge News Values
- Studying Daily Papers for Tips
- Learning What Interests Others
- The Value of Talking to Others

HOW TO WRITE AND DISTRIBUTE PUBLICITY
- Writing the News Release
- Writing a Story Lead
- The Details of the Story
- Physical Preparation of a Release
- The Various Editors on a Newspaper
- Should Publicity Be Localized?
- The Press Associations
- Using Columnists and Syndicates
- Use of Pictorial Publicity
- Use of Mats in Publicity
- How to Check on Publicity
- How to Contact Editors

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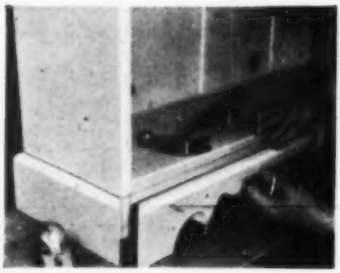

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Letters

Gus Cuts a Garage Bill

Sir:

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As I had planned a lengthy trip, I was stopped until I read the "Gus" story [Sept., p. 170]. Tried his trick—and the smoke stopped! Now, for about $8, I can get the booster pump repaired when I get back.

H. C. WARNER

New York, N. Y.

PS Behind the Curtain

Sir:

Here in Hungary we have a popular scientific magazine called "Life and Science." I was surprised to find in it an article about atomic energy illustrated with the same pictures you used with Volta Torrey's article, "U. S. to Breed Own Atoms," in the June issue [p. 124] of POPULAR SCIENCE. As one of your regular subscribers, I was angry only because there was no mention of where the pictures came from.

L. ZELENKA, M. D.

Szeged, Hungary

Apparently PS not only gets through the Iron Curtain, but gets read—and copied.

Can This Be Progress?

Sir:

Sing alas and alack for the Great American Automobile! Your September cover depicting the 1950 Studebaker is more than the conscience can bear. This perversion of automotive "engineering" has reached its nadir. The postwar greenhouses, bathtubs, and cracker boxes were shameful indeed, but this new airplanelike monstrosity indicates shockingly the depravity and poverty of imagination in the automotive industry today.

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GENERATORS
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(Shown at left—Instructor demonstrating latest type of Test Unit for checking the efficiency of a Motor.

AND RADIO-TELEVISION

On Real:

TELEVISION SETS
RADIO RECEIVERS
F.M. (Frequency Modulation)
RECORD CHANGERS
AUTO RADIOS
AIRPLANE RADIOS
PUBLIC ADDRESS Systems

(Right — Instructor explaining operation of 20-inch Cathode Ray tube used in Dumont Television Set.)

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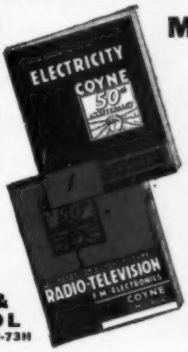

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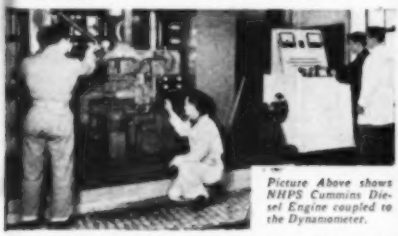

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Studebaker Champion, 1950

Stutz Bearcat, 1921

years ago? What has happened to the fine styling found in the Cord, Duesenberg, and, more recently, the Lincoln Continental? Go back even a third of a century to the noble lines of the Mercer Raceabout and the Stutz Bearcat. Can this 1950 rocket-to-the-moon be called progress?

Mr. Raymond Loewy and his cohorts, "industrial designers," have, for the sake of novelty and cheap sensationalism, taken the individuality and integrity out of a great American institution.

A plague on them.

O. LEE GORDON

Jacksonville, Fla.

Home-Safety Tip

Sir:

No matter how much you caution youngsters, they will get themselves into predicaments. As a step toward home safety, it is a good idea to remove the door catch from any old refrigerator or cabinet with tight-fitting doors that you are storing unused in your basement, attic, or garage. That will keep children from getting themselves locked in.

D. B. JOHN

Chicago, Ill.

Old Idea from an Inventor

Sir:

Among the "New Ideas from the Inventors" in your September issue [p. 106] is one that it's hard for me to believe is original. This is the one about a watering bowl for livestock that refills itself when a cow, pok-

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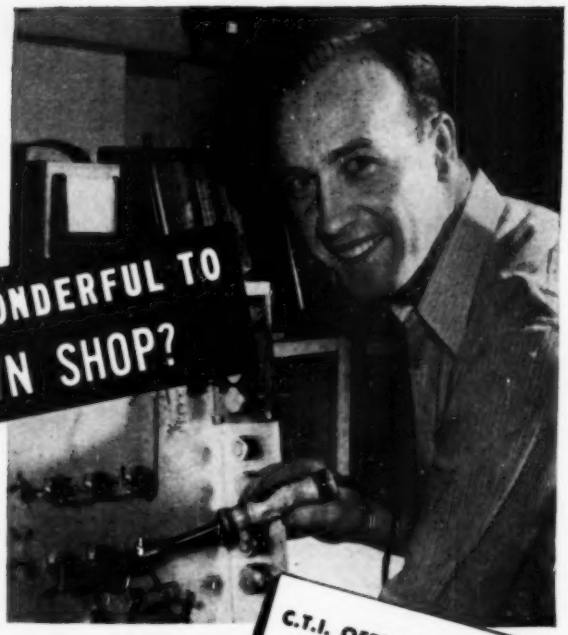

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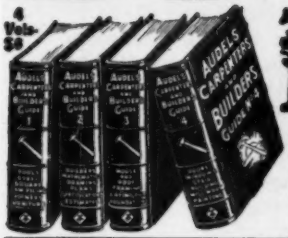

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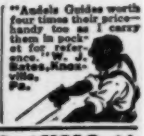

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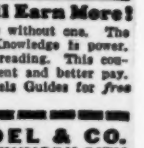

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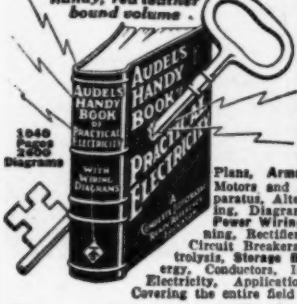

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ing its nose into the bowl, pushes down an arm to open a valve. The inventor, H. E. Bremer, of Milwaukee, is several years too late. If they have none of these in Milwaukee, it is about time.

JACK MATHEWS
Shreve, Ohio

. . . To my knowledge, this type of cup has been in use for several years.

BYRON COOPER
Nehalem, Ore.

. . . My father has had such bowls in the stables since before the war.

FRANCIS R. BARLETT
North Hollywood, Calif.

. . . at least 10 years. . . .

JAMES TRUSDLE
Clyde, Ohio

. . . 10 to 12 years.

ROLAND B. SICKLER
Clarks Summit, Pa.

. . . 15 years ago. . . .

K. O. NELSON
Pinto, Md.

. . . since 1932.

JOHN W. FISHER
Vergennes, Vt.

. . . two decades ago.

NOBLE E. PEELER
St. Paul, Minn.

. . . even 50 years ago. . . .

ROGER SESSLER
Jamaica, N. Y.

We surrender—but not unconditionally. The bowl PS pictured was patented May 10, 1949. The inventor claims its valve is an improvement over those of somewhat similar bowls on which seven U. S. and two British patents were issued from 1890 to 1930. He says it provides a smooth flow of water that doesn't startle the animals.

Buick's Right-Handed Dog

Sir:

In your picture of the heating ducts in the new Buick Special [Sept., p. 164] it appears that the driver's controls are on the right side. Was this particular car built for use in

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

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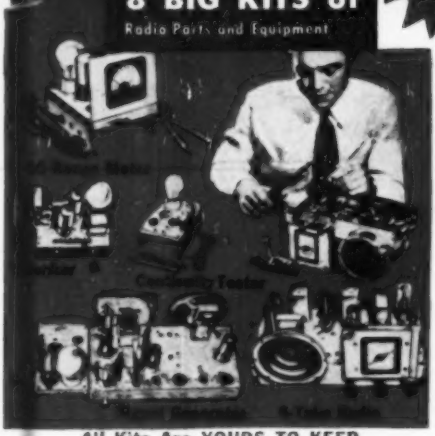

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Europe, or did someone in the darkroom put the photo negative in the printing frame upside down?

NORMAN THRASHER

Sharpsville, Ind.

The controls are on the right, all right; and the photo is not reversed. It happens to show—as PS probably should have noted—the driver's compartment of what Detroit calls a "dog" car: an experimental model.

Objection Denied

Sir:

On page 150 of your June issue is shown a radarlike device for the blind. It seems to me that its use would be rather limited, since the reflecting surface must be at just the right angle with the emitted light ray for the reflected beam to be directed exactly into the photoelectric cell.

SIGFRIDO LICHTENTHAL

Buenos Aires, Argentina

The Army Signal Corps, which developed the blind-man's eye, points out that reflected light is not bounced back in a straight line but scatters—something like what happens when a fire hose is turned on a brick wall. Hence the photo cell need not be at a 90-degree angle from the reflecting object. Besides, in actual use the device is moved back and forth in a scanning motion.

Merry-Go-Round or Carrousel?

Sir:

Instead of giving away a free subscription to artist Pioch for repairing your merry-go-round [PS, Sept., p. 10], you would do better to hire an answer man.

As I was taught, a merry-go-round goes clockwise and a carousal goes counterclockwise.

ERIC R. PLANITZER

Brooklyn, N. Y.

Coney Island's Steeplechase Park insists that its ride—which goes clockwise—is a carrousel (Webster's preferred spelling), and that any self-respecting merry-go-round goes counterclockwise. But Coney's American Museum of Public Recreation holds that either one can go either way without violating custom or offending precinct cops. Webster won't take sides, either—it uses the two names synonymously.

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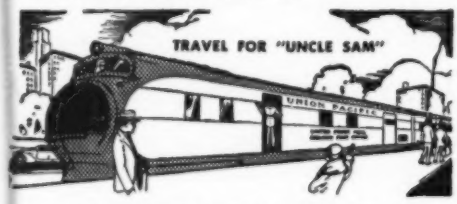

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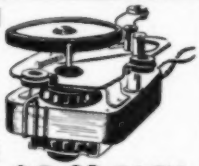

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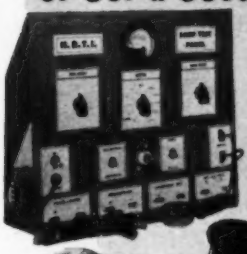

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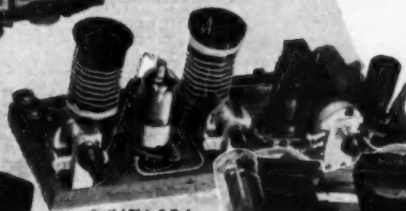

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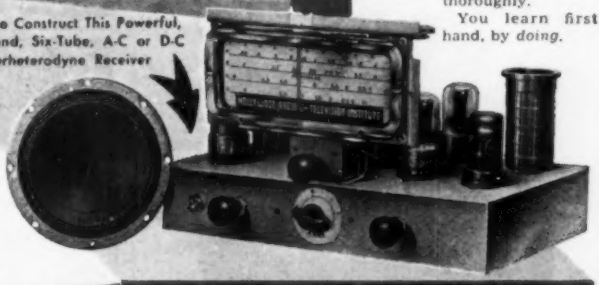

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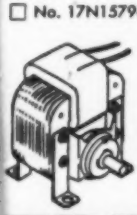

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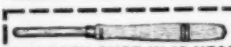

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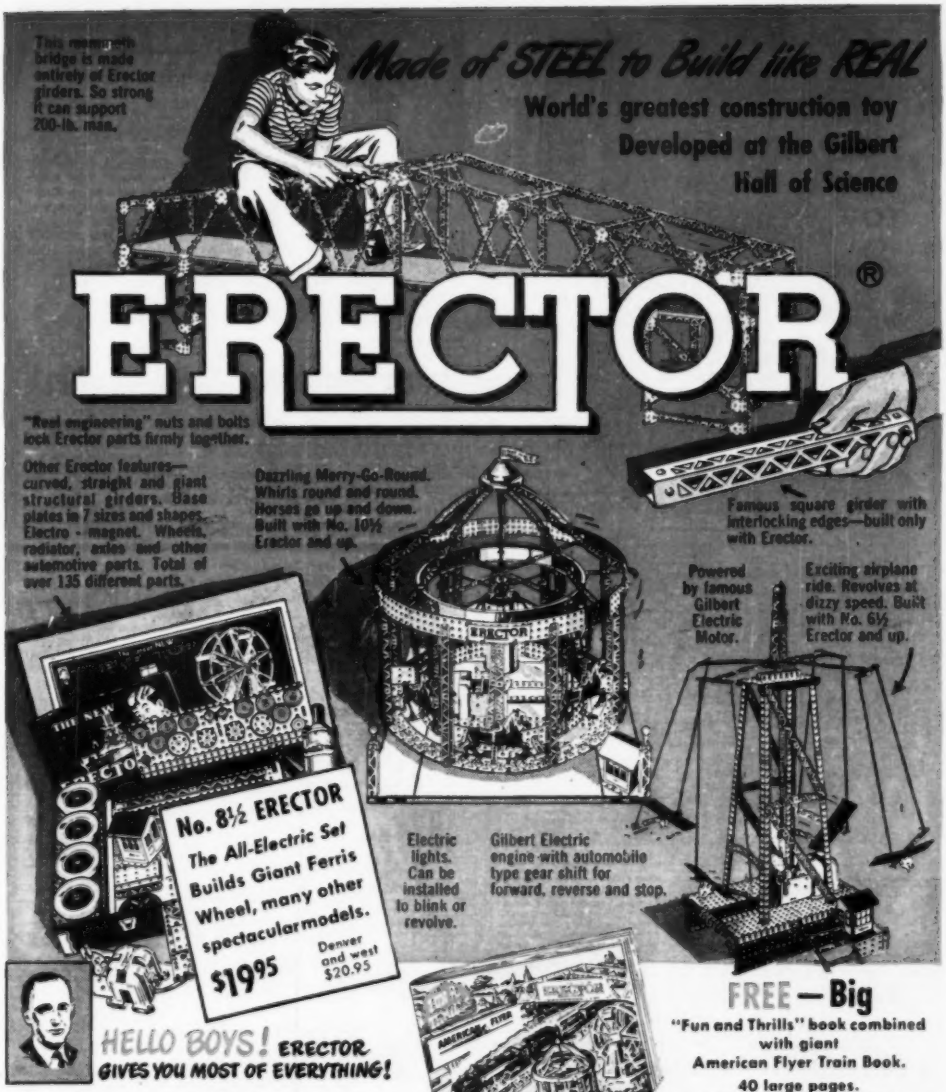

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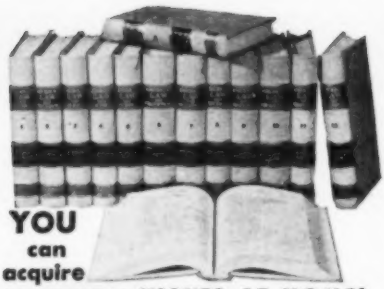

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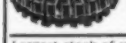

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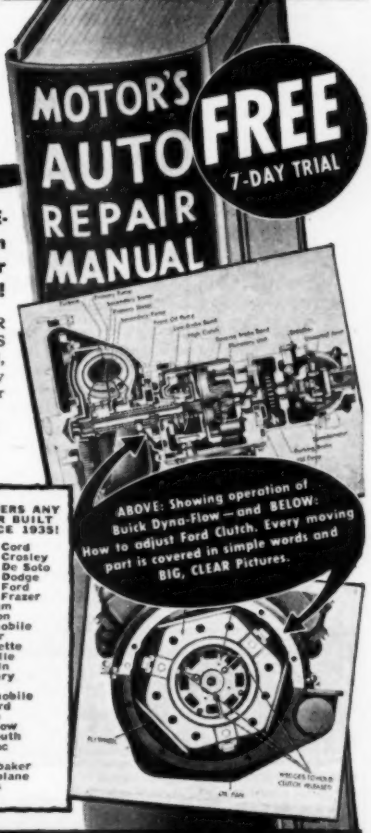

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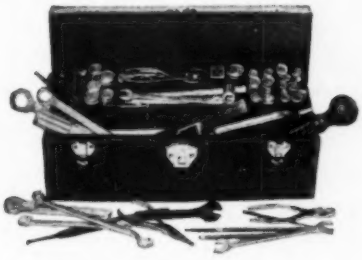

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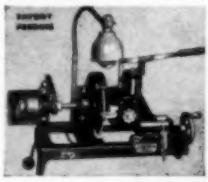

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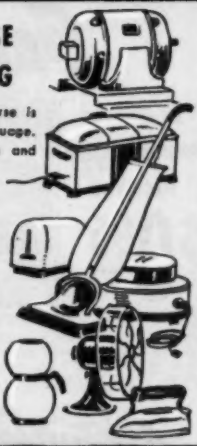

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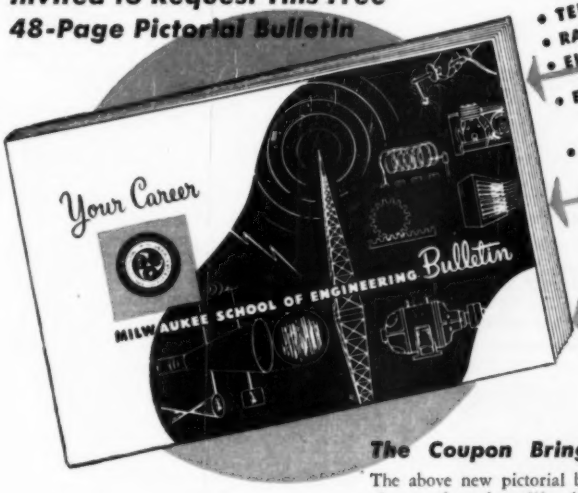

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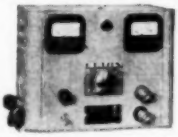

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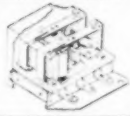

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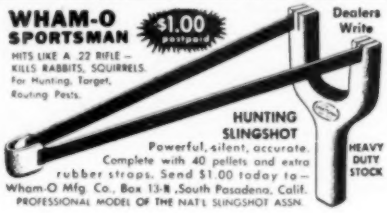

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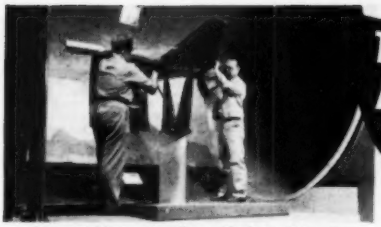

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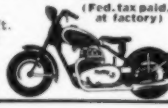

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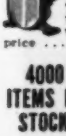

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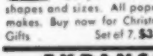

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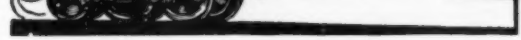

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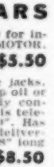

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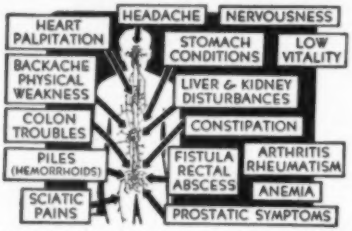

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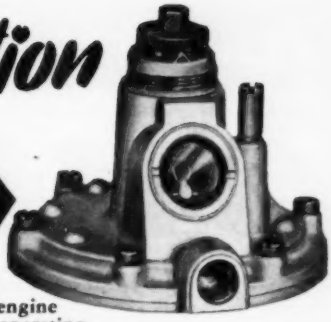

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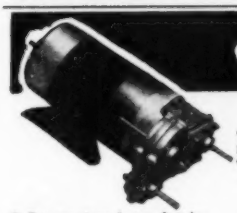

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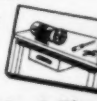

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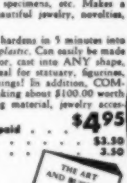

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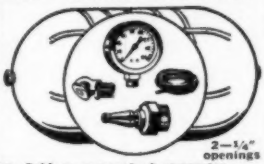

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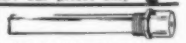

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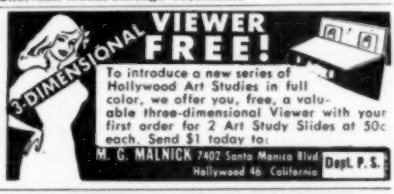

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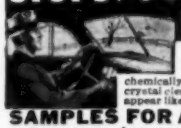

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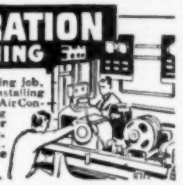

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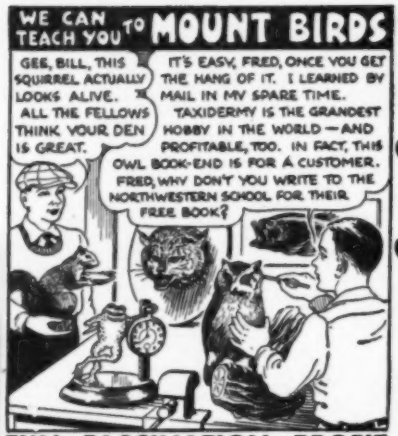

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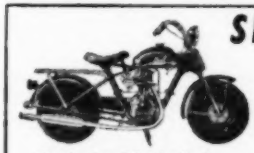

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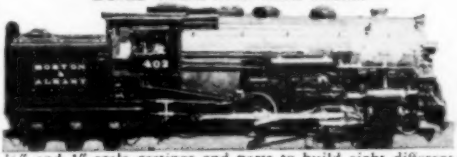

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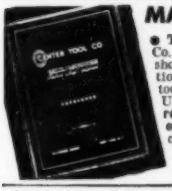

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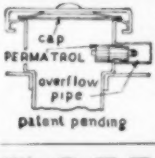

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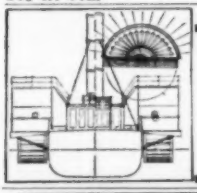

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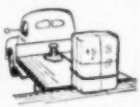

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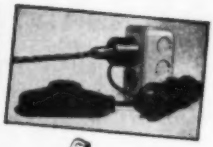

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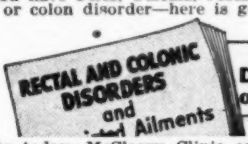

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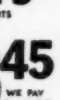

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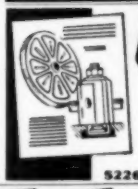

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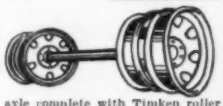

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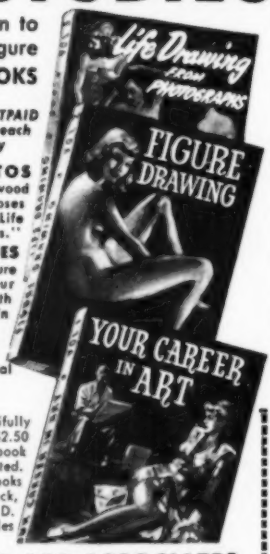

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"INDUSTRIAL Hand Cleaner." (Without Ammonia—Kerosene!) 400% Profit, manufacturing—distributing. Sample $1. Refunded, first order. Information Free. "Rythmo-H-Ex." Kingsport, Tennessee.

AMAZING, Marble—glazed cement pottery. Hollywood style, without moulds. Benches, fountains, stucco-rock walls, garden ornaments; chemically colored. Dime brings sample, pictures. Hollywood Cementcraft, 8527-B Wonderland, Hollywood 46, Calif.

WOULD you pay 3% —first $350 made? Book "505 Odd, Successful Enterprises" free! Work home. Expect something odd! Pacific, Oceanside, Calif.

ELECTROPLATE on non-metallics. Instructions $1.00. Four ampere plater $19.95. Eight ampere $29.95. 30 ampere $85.00. Kissel Electric Products, 431 Sherman, Galion, Ohio.

TIN Cans. Turn them into cash. Nine methods. Instructions 50c. Charles, 12-FP, Norwood, Ohio.

NEW Industrial Hand Cleaner. Free manufacturing-distributing plans. Unusual money-making proposition. "Acro-Sol-Ex." 623-D West 14th Ave., Denver 4, Colorado.

POPULAR SCIENCE OPPORTUNITIES

HOW and where to obtain Capital? Free details. Star Service. Wapakoneta. Ohio.

SAWDUST. Turn it into cash. Six methods. Instructions 25c. Charles. 12-FN. Norwood. Ohio.

MAKE Rich profits selling by mail—the "Natural" way. Hundreds successful! Interesting details free. Edward Lay. 3819 North Kenmore. Chicago 13.

HOSIERY. Sheets. Print Cloths. Etc! Wholesalers write for prices. Spartan Hosiery Company. Spartanburg. South Carolina.

MIX. Sell Chemicals Producing brilliantly colored wood fire flames. Unlimited winter sales. Sample 25 cents. Formula $2.00. Boone Consultants. 1181 Wilshire Court B. Cincinnati 30. Ohio.

"LIFETIME Repeat Orders!" Sell our Business Cards by Mail. $5.85 "Starter" Plan. Lynn. 5710-A Bankfield. Culver City 1. California.

MAKE flexible molds! Cast plaques, novelties, bookends! Free sample! H. Tooker. Hamilton 7. Ohio.

LEARN Piano Tuning, repairing at home. Tremendous field! Piano parts, tools furnished. Established 1935. Empire School of Piano Tuning. 606-A East University Ave. Champaign. Illinois.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart. Bridgewater. Massachusetts.

WHERE to buy 500,000 articles wholesale. Details free. Krueger. 3418B Wolcott. Chicago 13.

BABY Shoe Metalizing. Modern, Simplified, Practical system. Schoettle. Friendship 4. Ohio.

BIG Money—Spare or full time. Hand painting fabrics, ties, blouses, leathers, etc. is big business. New easy method. Help us fill demand. Free samples and complete plan. Hollywood Artlabs. 333-A E. 2nd. Los Angeles 12.

LIKE to Make $20-$40 Weekly at home? Proven mailorder Plan does it. Free Details. Perry Publications. 906-B North Wenatchee. Wenatchee. Washington.

MAKE Big Money in Home Mail Business! Few dollars starts you—interesting, profitable! Write: Smith. Box 2592-B. Hines. Illinois.

SELL Merchandise By Mail. Big Profit business! Everything furnished—orders filled for you! Easy, pleasant. Write: National. Box 88. Dorchester 22. Mass.

HAVE Home Mail Business Of Your Own —Run Ads. Mail Literature. Very profitable! Write: Ted Gordon. 711-L East 40th. Chicago 15.

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers. Box 23. Pawtucket. R. I.

TILE your own bathroom, kitchen, any room with colorful, guaranteed, amazing "Styron" Wall Tile. Save 30% at our prices. Save on labor costs. Simplified instructions. Free literature. U. S. Tile Co. 30-PS. West Washington. Chicago.

"QUICK Silverware, Gold, Jewelry, Metals. De-Tarnishing Atomic Plates." Dip, rinse, dry. 442% Profits. Manufacturers. 508-PS11B. New York St., Aurora. Illinois.

RUBBER! White liquid rubber! America's finest flexible molding rubber! New! Extra heavy viscosity! Quick drying! Ideal for home, classroom, or industry. Only $7.95 per gallon. $2.95 per quart, and $1.00 per half-pint sample. Parcel post prepaid! Plastercraft Supply Co. 3051 St. Clair Ave. Cleveland 14. Ohio.

BIG Money Regraining-Refinishing Automobile Dashboards—Garnish Mouldings. Write Outman. 4323 So. 38th. St. Louis.

FIGURINES and all Supplies for Dresden painting. Gift ornaments. Unpainted, many to choose from. Start a profitable business—hobby. Send 25c for Catalog. Will refund on first order. Suiter Art Industries. 314 Westport. Kansas City. Mo.

FOR more business rent New York office under your name. Rates—individuals—$12.00 yearly; firms—$18.00 yearly. Established 1926. Co-operative Office Service. PS—126 Lexington Avenue. New York City 16.

PROSPER with Plating! Growing Field! Easily Learned! Send Post Card. New Particulars Free. Joseph Kushner. Electroplating Engineer. Stroudsburg 78. Penna.

REAL money making opportunity making Interlocking Concrete building blocks. Rex Products Co., Dept. 21. Piqua. Ohio.

MAKE $24.50 Using Formulas from "Schemer" Magazine. Box 775P. Alliance. Ohio. Year $1.00. Three copies 25c.

"ELECTROPLATE" Baby Shoes! "We Furnish Everything." Foster. 1520 Ardmore. Chicago 26.

57 MONEY MAKING OPPORTUNITIES

NO selling, operate coin machines amazing profits, details Free. Parkway Corporation. Dept. 18. 623 W. North Avenue. Baltimore 17. Maryland.

PROFIT with Larson Leathercraft. Belts, purses, 100 other ideas. Largest supply in U. S. Catalog 10c. Larson. Dept. C. 826 S. Tripp. Chicago 24.

LEARN Sewing Machine Repairing at home. Install our wholesale motor kits. Make $125 to $300 a week. Free particulars. Taylor Service Co., Hamilton PS. Ohio.

DETECTIVES Earn Big Money. Experience unnecessary. Particulars free. Wagoner. P-125. West 86th. N. Y. N. Y.

MAKE Money At Home as renewal headquarters for all magazines. Big profit in Christmas gift sales. Liberal commissions. Supplies furnished. Catalog Free. Write McGregor Magazine Agency. Dept. 519C. Mount Morris. Illinois.

SCHOOL Seniors—Earn 40% commission selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft. Dept. M. 1425 E. Elm Street. Scranton 5. Pa.

"CAN You Wrap Packages?" Be popular during Christmas. Valuable throughout lifetime. Interesting gift selling item. Copy, profitable offer, $1.00. Holbrook Books. Box 1802. Milwaukee. Wisconsin.

WANT Notary Public appointment? Official in usually 10 days. Stationers Exchange. Boerne 50. Texas.

MAKE money at home. Sew garment bags, appliance covers, etc. from clear plastic. Patterns, instructions 20 items, $1.00. 54" material 5 yards $1.00. 100 yards $17.00. Postpaid. Steidl. Inc., Box 1663. Fargo. N. D.

"GET dollars in your mail." Your orders filled free! Write—Siwasilian. 4317-B Gleane Street. Elmhurst. N. Y.

$50 WEEKLY while learning Watch-Clock Repairing. See ad page 71.

MILLION Articles wholesale. "Supply Source Directory" 25c. Publisher's. Box 1302-AII. Detroit 31.

CASH in your spare time. Make Big Money sharpening circular saw blades with powered gummer. Free instructions, no experience necessary. Small investment, start with as little as $13.50. Big demand—you earn immediately. Free catalog. Belsaw. 315-G Westport Road. Kansas City. Mo.

WOULD You pay 3¢—first $350 made? Book "505 Odd, Successful Enterprises" free. Expect something odd! Pacific. Oceanside. Calif.

15 MINUTES masters advertising and sign lettering, complete system; sign painters' secrets; cartooning book; all three, $1; free circular. Abenterprizes. Box 875-A. Peoria. Illinois.

MAKE money at home in spare time. Raise Golden Hamsters. Small investment. Literature free. Golden Gate Hamstery. 631-G Richmond Street. El Cerrito. Calif.

WIN Contest Money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests. 1609-A East 5th. Duluth. Minnesota.

ADDRESS Mail circulars for advertisers. Full information and list of firms—25c. Write for other offers. Imperial. Dept. PS11. 902 South 9th. Wilmington. N. Car.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice. Argyle (2). Wisconsin.

MAKE Money! Apply photos on watch crystals, glasses, etc. Transparent. Complete directions. $1.00. Alvin Coblentz. Uniontown. Ohio.

ELIMINATE Financial Worries with the biggest money making Opportunity you've ever seen. Write Ages. West Liberty. Iowa.

CASH for Simple Ideas. Household and Shop Hints. E. W. Moses. Jr. Blacksburg Va.

58 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico. Park Ridge 15. Illinois.

10,000 FORMULAS and trade secrets. Free Literature. Stillmans. 555 Kingston Ave. Brooklyn 3. N. Y.

SNOWBOUND? SnowCar detailed working drawings—Parts list—$10.00. Callair. Afton. Wyoming.

FREE formula catalog, anything analyzed $20.00. Western Chemical. Salem. Oregon.

LABORATORY tested formulas. Lists free. Pont. Box 635-PS. Terre Haute. Ind.

59 PLASTICS

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hays Plastics. 2333 Lincoln Avenue. Alameda. California.

LUCITE. Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost: 1/16" 96c; 1/8" $1.25; 3/16" $1.52; 1/4" $1.80. Colors add 19%. Include 19% postage. Almac Plastics. 230 Fifth Avenue. New York 1. N. Y.

NEW Liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Complete kit only $3.95 postpaid, or send 25c for exciting new home project manual showing how to get started. Castolite. Dept. M-104. Woodstock. Illinois.

PLASTIC Hobbycraft: Material kit complete with instruction, project manual. $5.95, catalog 10c. Plastics. Box 1415. Salt Lake City 11. Utah.

PLASTIC. Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd. St. Louis 7. Mo.

INTERNAL carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Bound Brook. New Jersey.

WHOLESALE Plastics supply catalog 10c. Lucite, clear, colored. Metallic Acetate. Complete Castolite line. Phosphorescent, pearlizing pigments, dyes. Metal findings. Tools. Ideas—bargains galore. Fast delivery from stock. Gem-O'-Lite. Box 686-K11. North Hollywood. Calif.

PLEXIGLAS—Write for Free Price List. The Unique Glass Shop. 309 Cowardin Ave., Richmond. Virginia.

CARVING Special—Three color Dyes, one Drill.—$1.95 Postpaid—Free Catalogue. Craft Plastics. Somerville. New Jersey.

60 CHEMICALS AND APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting, Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn. 124-B West 23rd Street, New York, N. Y.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

NEW Laboratory supply catalog of Chemicals and Apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company. 1232 N. Paulina St., Chicago 22.

NEW catalog: Chemistry, mineralogy, biology, physics 10c. Tracey Laboratories. Evanston. Ill.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26. Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7. N. Y.

NEW, used. Catalog 10c. Atlantic Laboratory Supply. 21 Wenham. Boston. Mass.

POPULAR SCIENCE OPPORTUNITIES

61 HELP WANTED

BOYS Wanted. Over $2.00 hour! Sell name plates for front doors. Free Sample. Write Dept. 72. National Engravers. 214 Summer. Boston. Mass.

ALASKA. The Last Frontier offers unlimited opportunities. $1 brings government map and Directory listing firms in Fishing, Construction, Mining, Aviation, Fish & Game rules, Homestead data. Alaska Opportunist. Box 883-S. Hollywood 28. Calif.

$1,000,000 CONSTRUCTION Job Project Report. $1.00 brings Monthly News Bulletin giving authentic projects starting "world wide." U.S.A., Alaska, Canada, Pacific, Arabia, Latin America, India, Mexico, Africa, Europe. Tells How-When-Where to apply. Global Reports. P. O. Box 883-PX. Hollywood 28. Calif.

INTERESTED In Latin American And Foreign Employment??? $1.00 brings copyrighted "Foreign Service Directory" with complete listing of firms in Oil, Mining, Aviation, Construction, Steamship, Manufacturers, Importers and Exporters with Hot Tips for immediate application. Published since 1944. Global Reports, P. O. Box 883-S. Hollywood 28. Calif.

IMMEDIATE opening for reliable man with car to call on farmers. No experience necessary. $15 to $20 in a day. Permanent. McNess Company. Dept. 179. Freeport. Ill.

MEN-Women mail circulars spare time at home. Good pay. Mail 25c for samples. Instructions. P.S.-2441 N. Patton. Philadelphia 32. Pa.

FOREIGN Employment. Construction men, building trades mechanics, helpers, office men. Good workers needed for oil projects, mining, pipe lines, dams, power plants, roadways, shipping, etc. Transportation and quarters furnished; high wages. Listings of firms actively working and hiring on projects in South America, Arabia, Asia, Africa, Alaska, Central America, etc. Send $1.00 for foreign construction compendium and application forms. Foreign Service Bureau, Dept. P.S. 11 (Employment). P. O. Box 295. Metuchen. New Jersey.

FOREIGN Employment?? List of Overseas projects with application form. $1.00 Cash (C.O.D. $1.32). Foreign Service Institute. Box 3980. Miami 24-A. Florida.

62 AGENTS WANTED

GOOD Paying Business Silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures, etc., by late method. No tanks or shop required, outfit furnished. Free Booklet. Gunmetal Co., Ave. G. Decatur. Illinois.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19. Mass.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark. Chicago.

FREE water and our concentrates make flavors, lotions, shampoos. 125 products. Labels, bottles supplied. Qualco, F-20030 Russell. Detroit.

PHOTO-Salesmen-Agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

SEWING Machine electrification kit. Nationally advertised. Has Good Housekeeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least $5 per sale. For complete details write today to Brownell Distributors, Inc., Dept. PS. 308 Canal St., New York 13, N. Y.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 16. Chicago 4. Ill.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

START Your Own Business On Credit. Always your own boss. 1554 Dealers, sold $5,000 to $26,500 in 1948; their average $6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. K-U-PSC. Freeport. Ill.

FREE Samples. Big profits showing amazing Glow-In-The-Dark specialties. House numbers, pictures, plastic novelties, religious and nursery objects, etc. Large manufacturer. Madison Plastics. 303 Fourth Ave., New York 10, N. Y.

1949 CHRISTMAS Card Catalog Now Ready! Earn more Money! Be a wholesale Jobber! A large selection of Box Assortments, Imprint Lines, Religious, Personalized Cards and Christmas Novelties. Three sample boxes, retailing for $2.60, only $1.00 postpaid. Catalog Free! Elfko, 440 North Wells. Chicago 10.

STOP! Want to make money all year round selling a complete line. Wool and Cotton Embroidered Uniforms for summer and winter wear, shirts, caps, ties, badges, 2000 emblems, personal initialed buckles, belts, and hundreds of other easy-to-sell items. Sales Kit furnished. Please write today. Hook-Fast Company, Box 480 PS. Roanoke. Va.

BE Renewal Headquarters for all magazines. Big profit in Christmas gift sales now. No experience—No capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 519A. Mount Morris. Illinois.

FAST profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Company, Dept. P-11, 347 Broadway, Passaic, N. J.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-119, 7530 Greenwood. Chicago.

NYLON, Poplin, Rayon Uniforms, white and colors. Immediate Delivery. Immediate Profits. Sell to Doctors, Dentists, Nurses, Waitresses, Beauticians, Housewives. Free Sales Kit. Superior Fabrics. Dept. A11, 3936 Market St., Phila. 4. Pa.

SCHOOL Seniors!!! Your postal will bring our wonder, Kwick-Sell Cardalog of popular Graduation Name Cards. Biggest profits!!! Only firm giving free souvenir chest and Card Case. Don't miss out! Hurry that postal!!! Craftcards. Box 235 (M). Pittsburgh 30. Pennsylvania.

BIG Bargains for Big profits. Over 100 sensational values. Men's used suits $2, pants 35c, topcoats $1.25, overcoats $2, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-B Jefferson. Chicago 7.

OWN Your Own Business. Sell Men's Neckwear full or spare-time. Low investment, big profits. Send $1.00, receive two Sample ties plus free catalogue, color portfolio, selling plan. Radio City Neckwear. Dept. P.S. 4. 112 W. 50th. N. Y. C.

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 137. Akron. Ohio.

NEW Bathroom Deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 138. Akron. Ohio.

$5,000 between now and Xmas showing new smart Firestone Velon. "3 in 1" Shopping Bag. Women buy several. Commissions Advanced daily. Sample Furnished. Lenard. 179-R. Washington. Chicago.

CANVASSERS, Crew Managers! Bigger profits with our beautiful popular priced fast selling stainless table-ware. Guaranteed for a Lifetime! A terrific door opener. Write direct to manufacturer for details on how you can become a direct factory dealer in your area without any risks. John Hull Cutlers Corp., 1239 Broadway, NY 1, NY.

DRESSES 18c; Men's Overcoats $1.00; Skirts 50c. Free Catalog. Crown, 164-PS Monroe St., New York 2.

FREE Nylons given if Kendex hosiery runs or snags. World's only women's hosiery sold with written guarantee amazing everybody. Mere words could not express unbelievable money making opportunity. Fantastic earnings become reality. Armstrong earned $202 in 9 days. Watkins sent 92 orders in one day. Imagine replacing hosiery free regardless of cause—whether use or abuse! Truly sales dynamite for terrific profits. Even if you never sold before, three magic words: "Guaranteed Against Everything" will open doors for you—make women listen and pour money in your pocket. Nationally advertised in Life, Ladies Home Journal, Saturday Evening Post, McCall's and Woman's Home Companion. Awarded Seal of Approval by Good Housekeeping. 75 million readers will see Kendex advertising to help you make quick sales and big money. Complete line from sheerest 15 denier 51 gauge to heavy 70 denier service. Sizes 8½ to 11½; lengths 28 to 35 inches; latest fashion colors plus white; full fashioned seamed and seamless. No competition because Kendex nylons are not sold in stores. Also complete line men's hosiery actually guaranteed for one full year or replaced free. Nothing like this anywhere. Includes rayon, nylon, lisle, wool, cotton, mixtures, etc. All styles, patterns, colors, prices to please everybody. 200,000 pairs constantly in stock for fast delivery. Thousands shipped daily. Over 30 years in business. You need no money or experience. Nothing to pay now or later. Just show free outfits. Write orders. We deliver and collect. Big advance cash plus huge bonus. Earn money spare or full time—exclusively or as side line. No restrictions. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman, young or old, experienced or beginner, you can make money and friends writing orders. Everything you need is furnished free, including sales books in color, samples of hosiery materials etc. Simply write your name and address on postcard and make money next week with money-making outfits sent free and prepaid. No obligation. Kendex Company. Babylon 24. New York.

SELL ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c—Sells 35c—Make money. 15 samples ultra-blue signs "7x11"—$1.00 postpaid. L. Lowy, 8 West Broadway, Dept. 505. New York City.

SELL Big Money-Maker to men and Women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company. Brockton 64. Mass.

$100 WEEKLY—Complete, modern Plastic line. Tablecloths, etc.—25 items. Every home prospect. 100% profit. Ideal for Demonstrators. Carwell, 6828-BB. South Chicago Avenue. Chicago.

NEW Items! Fast Seller! Big Profit! Large selection including billfolds, musical instrument novelties, household utensils. Perfect gift items for men, women, children. Write for Free Illustrated catalog. Ermo. Dept. S. 507 5th Ave., N. Y. 17, N. Y.

SELL Slot Machines, Games, Home Bars. Send for wholesale deal. Webb Distributing Co., 4966 West Chicago Ave., Chicago 51, Ill.

AGENTS! 100 Brand New Products. Confidential Bulletin Monthly. Publishers, Gardenville 4, N. Y.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save". Service Publishing, 218-B Investment Bldg., Pittsburgh 22, Pa.

SELL Lamps for Big Profits . . . . Fast selling quality table, boudoir, electric hurricane lamps, etc. Every home a prospect. Commission in Advance. High Profits on every sale. Write today for Free Selling Kit. Paramount Products, Dept. P-1, 1205 Sherwin Avenue. Chicago 26. Illinois.

LOOK! Make money all year round selling personal initialed individualized belts, buckles, cap badges, tie holders, complete line Police and Firemen's Badges, 2000 emblems to choose. Big profits, whole or part time. Please write today special outfit offer. Hook-Fast Specialties. Box 1425, Dept. 7, Providence, R. I. Established 1926.

FREE Folio, Wholesale Supply Sources, Business deals, Plans, Ideas, Formulas. Kolamite Co., Box 572 C. Dayton, Ohio.

POPULAR SCIENCE OPPORTUNITIES

SELL 12 Fire Extinguishers. Locally mailorder. Lorrac Products, Albany 1, N. Y.

WOULD you pay 3%—first $350? Book "505 Odd, Successful Enterprises" free! Work Home. Expect something odd! Pacific Oceanside, Calif.

BIG Profits start your own business at home stamping key protectors, social security plates. Tools and stock $17.50 complete. Sample name and address 25c catalog free. General Products, 11 No. Pearl (PS), Albany 7, N. Y.

WIN Suits and Earn Money! Both easy with amazing plan. Show finest made-to-measure tailoring to friends, neighbors. No experience or investment. Free outfit. Write Stonefield Corp., 1300 W. Harrison, Dept. Y-821, Chicago 7, Ill.

UP to $50.00 in a week and tailored suit for yourself without paying one cent. Write for plan. Progress Tailoring Co., Dept. Y-221, Congress & Throop, Chicago 7, Ill.

MAKE Big Money! Selling our fine line of cosmetics the year around. Write: Sedoni Laboratories, 428-S, New York Bldg., St. Paul 1, Minn.

SELL!! Balloons, Combs, Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

NEWEST money-making sensation, miniature authentic replicas, police and firemen's badges, also pocket pieces, key chains. Write for descriptive folder. Hook-Fast Specialties, Dept. 23, Box 1425, Providence, R. I.

WHERE To Buy 800,000 Articles Wholesale! Details Free. Schibani, Box 1576-S, Birmingham 1, Ala.

LOCAL Franchise, Power Mower—$49.50. Delivered. Act Quick! Modern Products-4, North Kansas City, Mo.

SPECIAL pleasant work at home. Earn in your kitchen. Good earnings. Send no money. Styleco, Dept. 63, Cincinnati 2, Ohio.

SELL "NuSilver Plating Liquid". Cloth applied. Renews silverware like new. Silverplates brass, copper. NuSilver, 508-PS11A New York St., Aurora, Illinois.

PAINTS—Enamels, Roofing 65c gallon up. Your name on label. Certified Products, 812 F 38th, Louisville, Ky.

CHRISTMAS and Everyday Greeting Card Bargains. 4154-B Fifth Street, Philadelphia 40.

DOUBLE your Income Selling Colorful Sportswear, Shirts, Jackets, Nitewear, Nylons, Dresses. Free outfit. Jarod Manufacturing—Rockville Centre 12, New York.

AGENTS. Sell finest Food Products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sale plans make sales easy. Permanent repeat business. Samples furnished. Live territories open to Distributors. Mother Hubbard Products Co., 4139 Grand, Dept. PS, Chicago.

63 HIGHGRADE SALESMEN

BIG Money Taking Orders: Shirts, Ties, Sox, Pants, Jackets, Sweaters, Shoes, Uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AV Lincoln, Chicago.

LOOK Here! Wanted—Men and women to start in business on credit. Sell some 200 farm-home Products. Thousands our Dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. K-192-PSC, Freeport, Ill.

SALESMEN—Put yourself in line for big money, real future. Keep stores supplied with 5c-10c to $1 counter goods. Nationally advertised. Top profits for you and merchants. Liberal deals boost sales. Sideline or full time. World's Products, Dept. 83-A, Spencer, Ind.

SALESMEN: Take orders for Laminite Signs. No electricity yet glow like neon. Creating sensation: Big advance comm. No investment. Laminite, 1544 Cortland, Chicago 22.

67 EDUCATIONAL AND INSTRUCTION

MATHEMATICS. Individualized instruction. NCS, Box 27, St. Johns Station, Brooklyn 13, New York.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" Bookkeeping and Tax Service. Full or Spare time. Details Free. No obligation. Ellis, Box 303, Cedar Grove, North Carolina.

EXPORT! Learn at home from established World Trader. Big paying positions. Your own profitable world-wide business by mail order without capital; or travel abroad. Experience unnecessary. Free booklet. Mellinger, 211 W. Los Angeles 24, California.

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PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

MAKE Up To $35-$45 Week as a Trained Practical Nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-11, Chicago.

BECOME a Doctor of Psychology or Metaphysics. Teach secret of contentment, happiness. Win degree of PsD. or MsD. Solve mental worries. Free book. College of Universal Truth, 5153-K N. Clark, Chicago.

STUTTERING or Stammering Corrected at Home. Amazingly successful method. Send for free literature showing how you, too, may overcome stuttering at home. The Atheneum, P-211, 1714 Chestnut, St. Louis 3, Mo.

U. S. GOV'T Jobs! Start high as $3,351.00 year. Men-women. Qualify now for secure positions. Free 40-page book, sample tests. Write: Franklin Institute, Dept. Y-22, Rochester, N. Y.

SHORTHAND in One Week! Easy longhand system $1.50. Zinman 215A, West 91, N. Y. C.

GRADUATE Degrees, psychology, divinity, others. Directed home study. Free bulletin. Central Ecumenical College, Inc., Dept. SP, 14 N. East Street, Indianapolis, Indiana.

WANT a steady Big Pay Job in Diesel? Our approved, easy-to-understand Diesel Training Course qualifies you. Placement advisory service Free. Learn as you earn. Write for free 24 page book today! Interstate Training Service, Dept. 2M, Portland 13, Oregon.

INEXPENSIVE Manual teaches air conditioning. Write Don Nelson, Warner Robins 3, Georgia.

HYPNOTISM. Complete course, 20 illustrated lessons $1.00, moneyback guarantee. Baltimore School of Hypnotism, Dept. 23-A, 4214 Belmar Ave., Baltimore 6, Md.

LEARN Gunsmithing. Details and copy "Guns and Gunsmithing." 25c. Gunsmith's, Palatine, Illinois.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-B, Austin, Texas.

RAILROAD Telegraphy quickly learned by mail. Starting pay approximately $265.00 monthly for 5 day week. Paid vacations. Free travel passes. Telegraphers needed Now. American School Railroad Telegraphy, 102 Phipps Bldg., Wenatchee, Wash.

DENTAL Technicians Kit. Artificial teeth, plastic, etc. Technicians' manual. Grant Laboratory, 219 W. 7th, Los Angeles 14, Cal.

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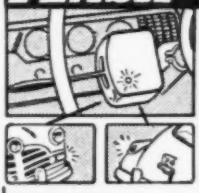

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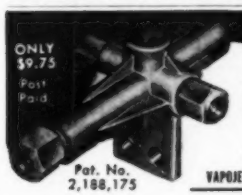

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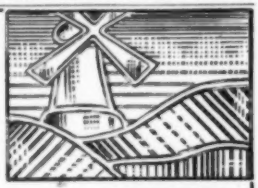

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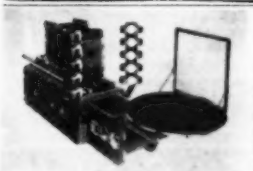

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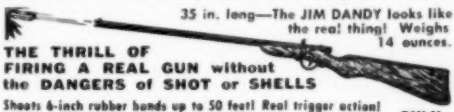

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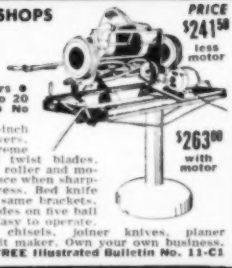

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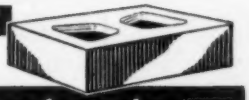

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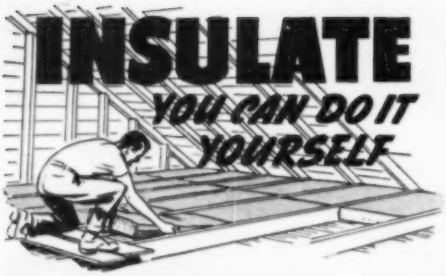

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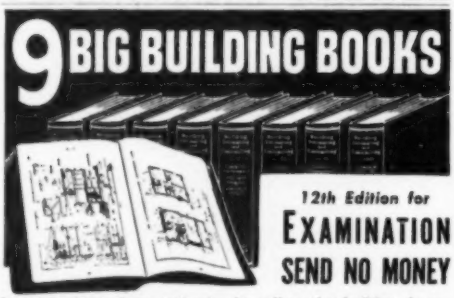

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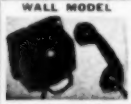

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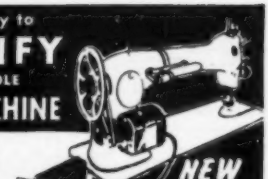

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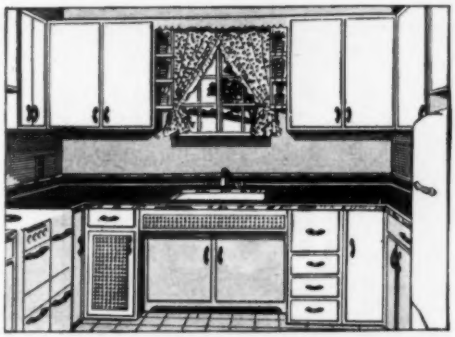

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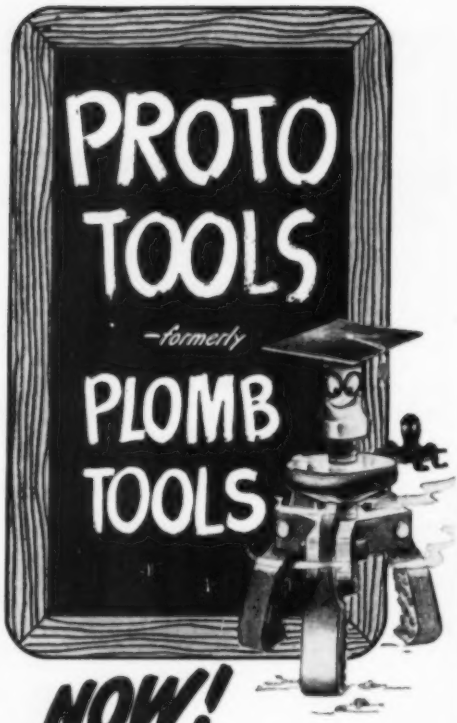

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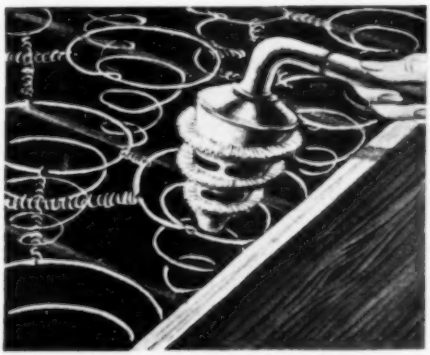

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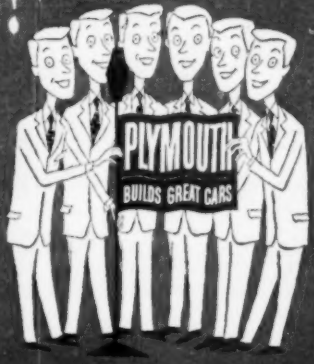

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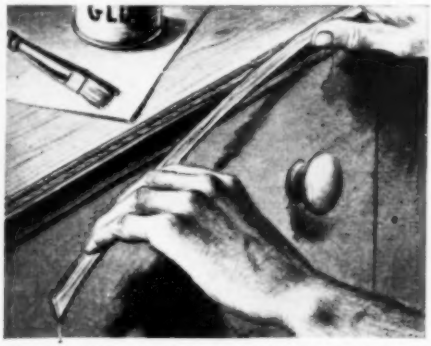

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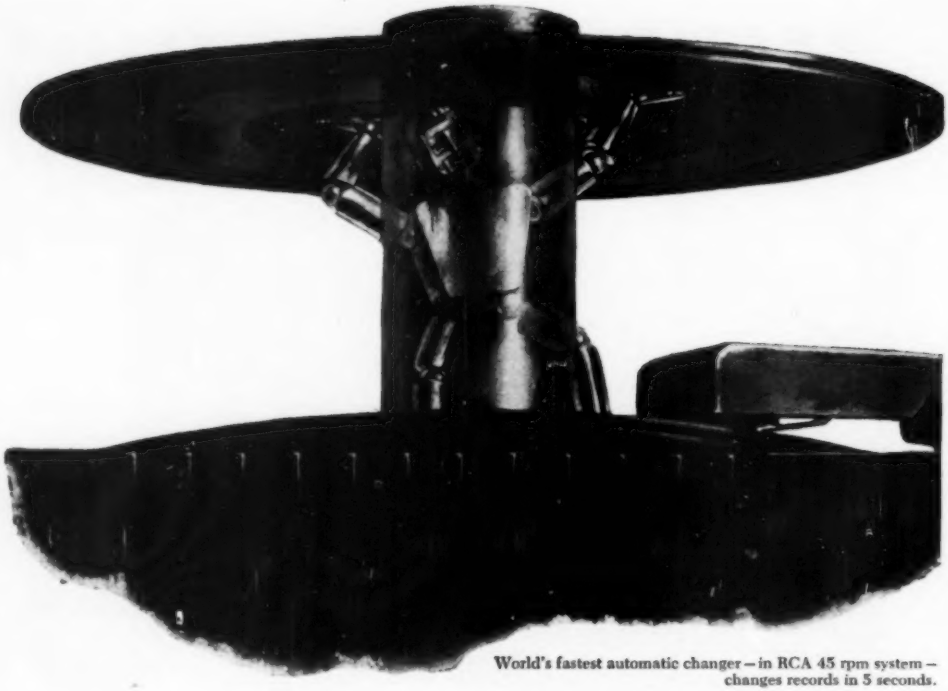
BURGESS BATTERY COMPANY HANDICRAFT DIVISION LAKE ZURICH, ILLINOIS



World's fastest automatic changer—in RCA 45 rpm system—changes records in 5 seconds.

Quick change artist

Hundreds of thousands are now enjoying RCA's thrilling new way of playing records . . . they marvel at its wonderful tone, its compactness . . . and the speed with which it changes records.

Prolonged research is behind this achievement, research which sought—for the first time in 70 years of phonograph history—a record and automatic player designed for each other.

Revolutionary is its record-changing principle, with mechanism *inside* the central spindle post on which records are so easily stacked. Result: a *simplified* machine, that changes records in 5 seconds.

Remarkable, too, are the new records—only 6¾ inches in diameter—yet giving as much playing time as conventional 12-inch records. Unbreakable, these compact vinyl plastic discs use only the distortion-free "quality zone" . . . for unbelievable beauty of tone.

Value of the *research* behind RCA's 45 rpm system—which was started eleven years ago at RCA Laboratories—is seen in the instant acceptance, by the public, of this better way of playing records. Music lovers may now have *both* the 45 rpm system, and the conventional "78."

* * *

Development of an entirely new record-playing principle is just one of hundreds of ways in which RCA research works for you. This continued leadership in science and engineering adds value beyond price to any product of RCA, or RCA Victor.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

PS
The Voice of Science

Where Do Ideas Come From?

The man in the sport shirt was one of several who came forward for a private word after I had finished the talk before the local Air Force Reserve.

He said, as many do, "I've got an idea. . ."

People have some reason to be wary of other people's ideas. Too many ideas are too old, or involve too much trouble or money—yours, of course. So the natural rejoinder, sometimes unspoken, is "so what?"

But an editor must stoop for the smallest coins of thought. So I said politely, "Good! Just write it down and send it in." Editors also know that writing it down is the best test of thinking it out.

"Nuts," said the man in the sport shirt. "I don't want to write it down, or make anything out of it. I just want to see it happen.

"I'm a radarman, see? I was watching those blips on the scope one day, and I had an idea, see?

"I said to myself, every big ship carries radar nowadays, but suppose something happens. Suppose you got people in lifeboats, in all that water.

"So you got radar, but a lifeboat's low in the water. Hard to see day or night. Hard to see on radar, too. Birds on seaweed can make as big a blip on the scope.

"My idea is why don't they put in every lifeboat these tinfoil targets they got. They got to carry water and biscuits and a lot of other stuff by law.

"So why don't they make a law that every lifeboat should carry one of these tinfoil targets? They fold up small; but when you open them up and hoist them up on a mast or something, they sure make a nice big blip on the radar!"

I had not been talking about radar or sea disasters. But the man in the sport shirt saw a chance to put his idea into action by getting it into print. There was no question of profit, or even recognition. So many people were talking at once I didn't even get his name. But I know his real name.

I hope he sees this, because I think he has a wonderful idea. I'm going to make sure the Coast Guard sees it, too. That package of aluminum foil and struts, technically known as a Tetrahedron Reflector, can be radarseen many times visual distance. It might save more lives than some of the other gear now prescribed for lifeboats.

The interesting thing is that this idea sprang whole from a human mind scanning the possibilities, as a radar antenna squirts its searching waves, seeking a reflection of the projected thought.

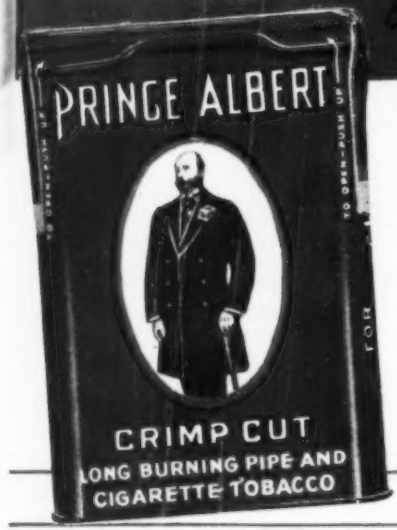
Where do ideas come from? An idea is the Genie of the lamp of thought. Produced by the friction of the mind rubbing around a problem, or a necessity, or a hope.

The real name of the man in the sport shirt, as you have guessed, is Aladdin.

Perry Gilkeson

*Anyone can tell he has P.A.**

P.A.* means Pipe Appeal and Prince Albert

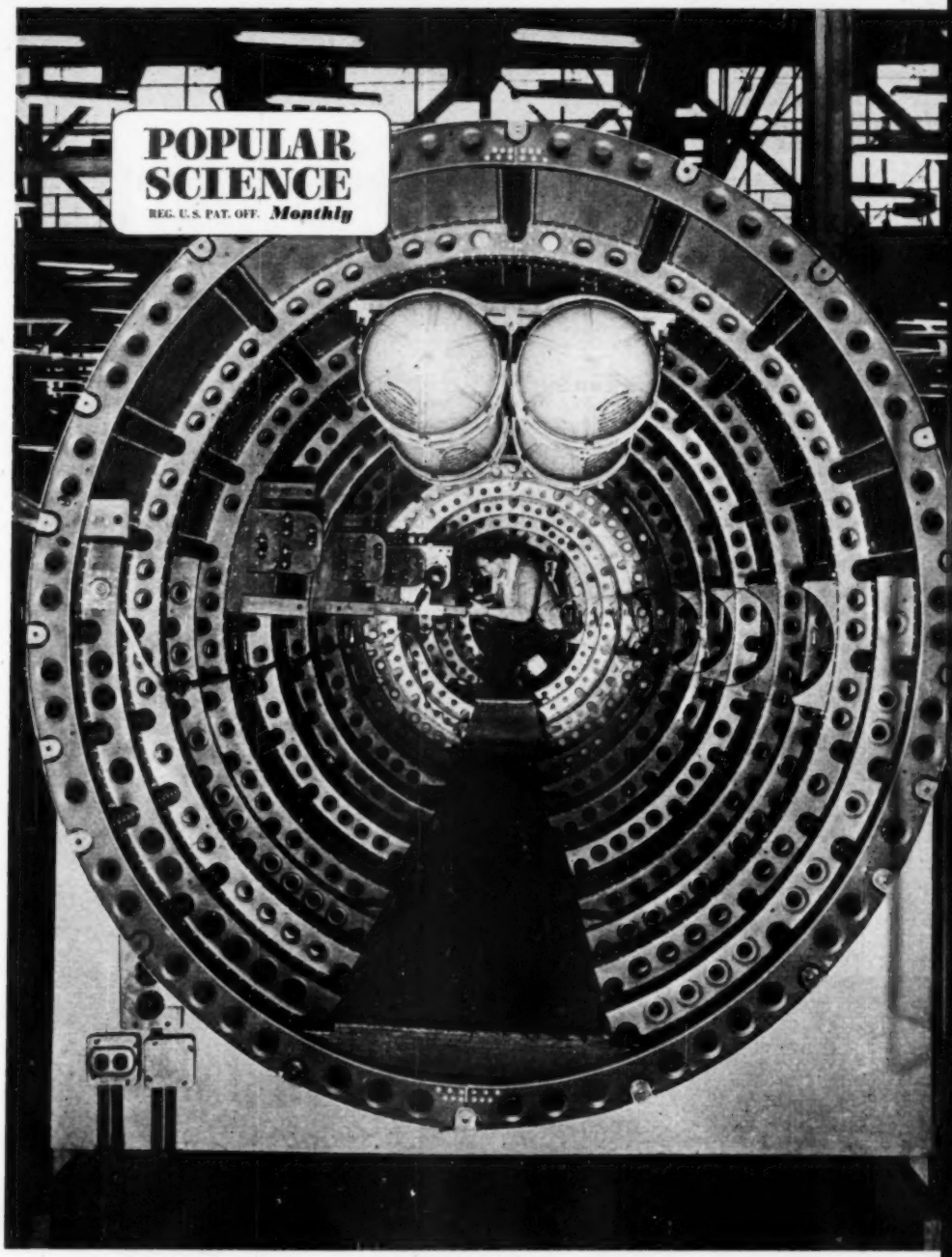


YOU CAN tell by the ladies' admiring glances when a man has Pipe Appeal. And you can tell by his contentment that he has that pipe packed with mild, rich-tasting Prince Albert! That choice, crimp cut tobacco is specially treated to insure against tongue bite. Get P.A.—and see why it's America's largest-selling smoking tobacco!

P.A.'s GRAND FOR ROLLING CIGARETTES, TOO!

R. J. Reynolds Tob. Co., Winston-Salem, N. C.

THE NATIONAL JOY SMOKE



Tail End of a Boom... Here you're looking down toward the rear end of one of two tapering throats that form the twin tail booms of a huge Fairchild C-119 Flying Boxcar transport plane. This unusual view, taken just before the boom was lowered into place for assembly, shows a worker putting the finishing touches on a heating duct that supplies the tail surfaces with hot air for de-icing. A successor to the original C-82 Packet, the C-119 has more power, longer range, and can carry a greater load for the armed forces.

Cover drawing by Reynold Brown

The Inside Story of

A racing champion designs a tunnel-shaped

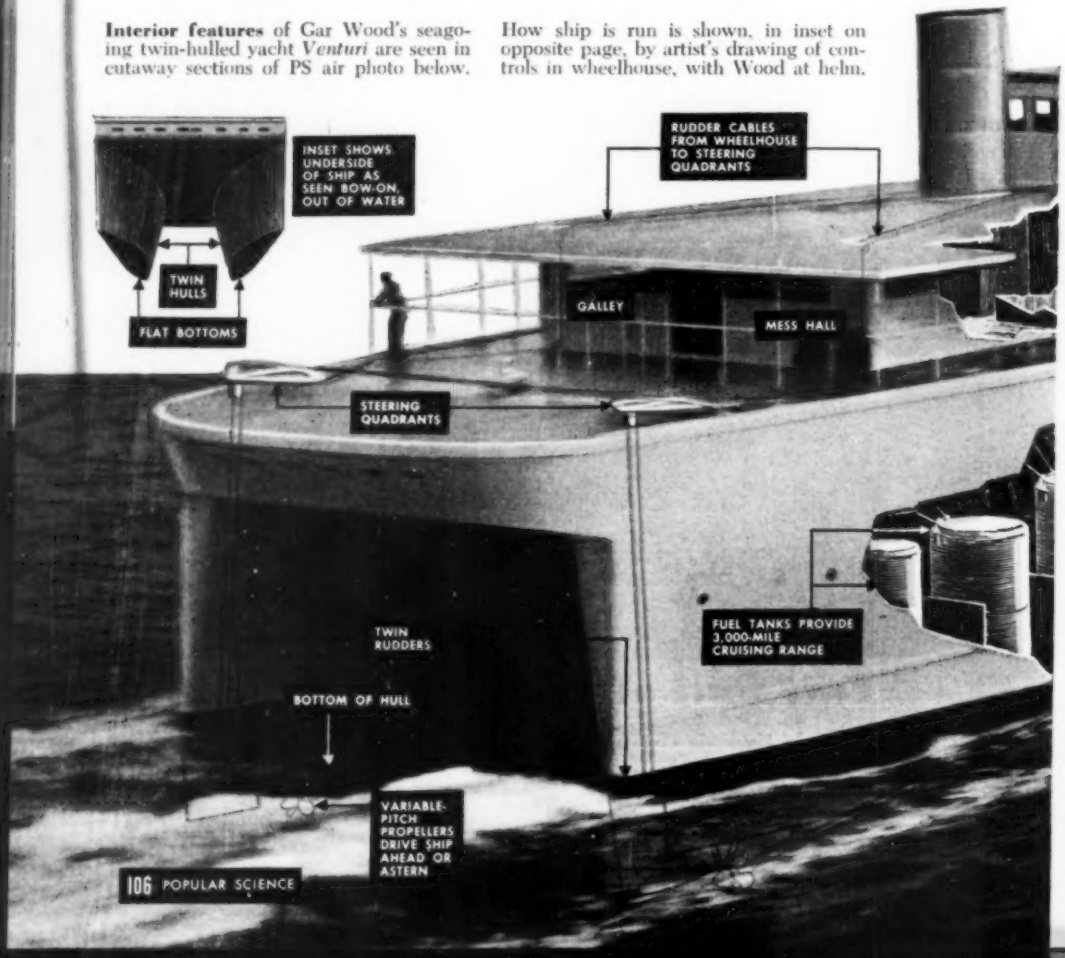
By Alden P. Armagnac
PS photos by W. W. Morris

BECAUSE an inquisitive experimenter sawed a boat in two, tomorrow's ocean voyagers may enjoy unprecedented speed and comfort aboard liners of new design.

The man with the saw was Gar Wood, silver-haired king of American motorboat racing. He sliced a conventional boat hull down the middle, transposed the two halves, and joined them with a superstructure. And he found he had a better boat.

Now the 68-year-old inventor envisions a superliner applying this design—a giant floating tunnel 900 feet long. Twin hulls would be bridged by decks with accommodations for at least 4,000 passengers. Four steam turbines, totaling some 120,000 hp., would propel the bizarre ship at 35 to 36 knots, a

Interior features of Gar Wood's seagoing twin-hulled yacht *Venturi* are seen in cutaway sections of PS air photo below. How ship is run is shown, in inset on opposite page, by artist's drawing of controls in wheelhouse, with Wood at helm.



Gar Wood's Sea Speeder

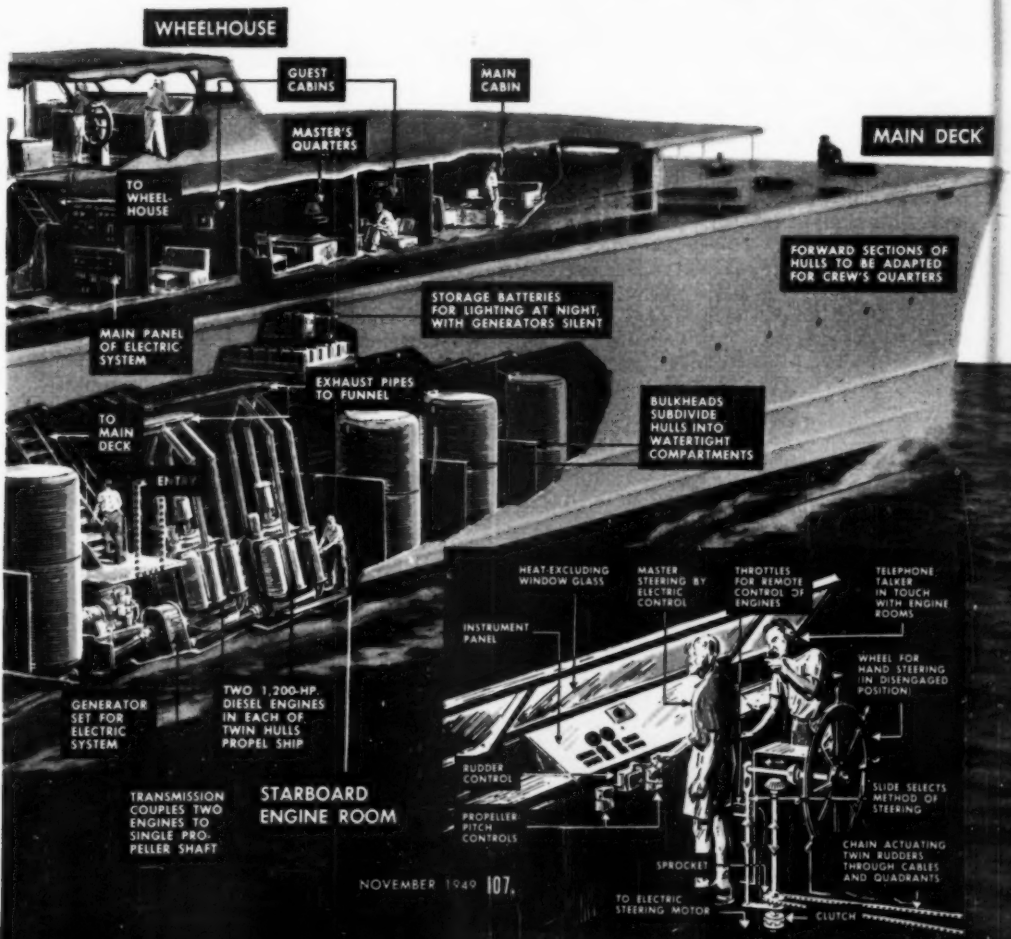
boat that looks like an inventor's pipe dream—but works.

phenomenal pace for commercial vessels. (The 80,000-ton *Queen Mary* uses 200,000 hp. to carry about 2,000 passengers at a top speed of 32 knots.)

Free from rolling, pitching, and yawing, the "tunnel boat" would provide new comfort for its passengers. Since these motions slow an ordinary ship, their absence would contribute to the new liner's top speed and to economy of power and fuel.

A king-size working model, Gar Wood's $600,000 dream boat *Venturi,* demonstrates the principles of his new design. First publicly exhibited last August in trial runs off Miami Beach, Fla., this radical craft currently serves as a floating laboratory to test and perfect its builder's plans.

Pictures don't prepare you for the impressive size of the big, white, brown-roofed, silver-funneled ship. The *Venturi*



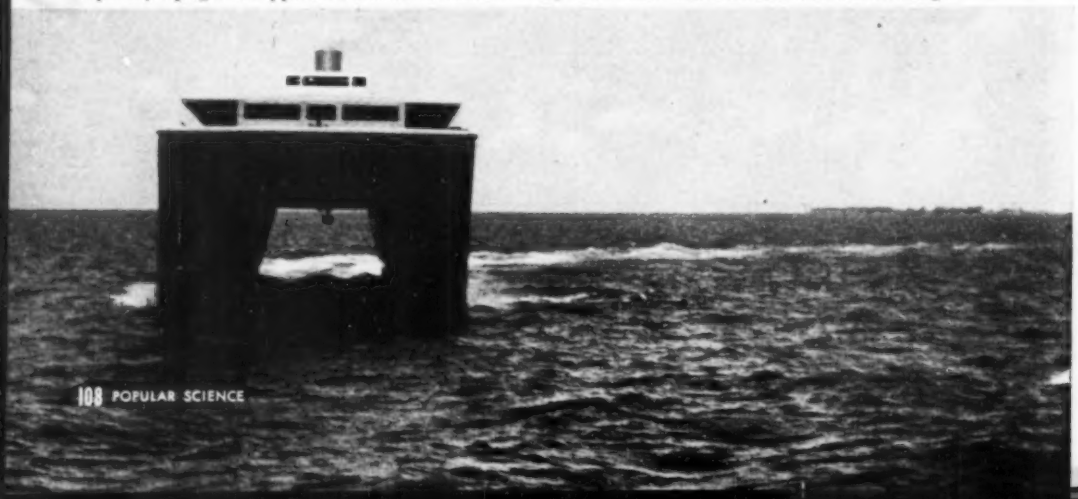
Using small wooden models. Gar Wood compares stability of conventional hull designs and his own in swimming pool on his Miami Beach estate. Although PT boat at left is one of most stable of standard types, model lists to about twice the angle of twin-hulled model after same number of weights representing unbalancing force has been placed along the side of each.

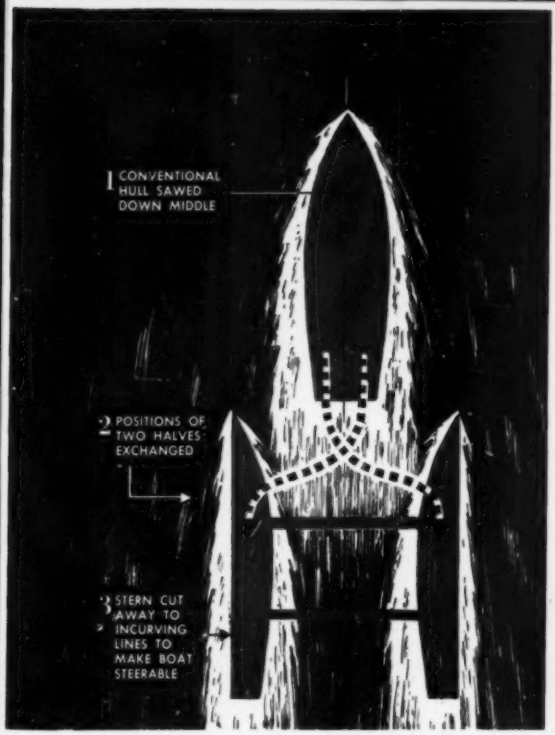
is a seaworthy, ocean-going yacht, 188 feet long with a 40-foot beam. Cabins occupy the center of a nearly oblong main deck resembling an aircraft carrier's. Connecting the two hulls 22 feet above the water, the superstructure forms the roof of a floating tunnel, as wide as the ship at the bow.

Shoehorned into the narrow hulls, four Diesel engines totaling 1,200 hp. turn two 4½-foot variable-pitch propellers. Top speed remains to be learned when the new engines are broken in and can be opened up. At less than full power, the *Venturi* has reached 26 knots in sea trials.

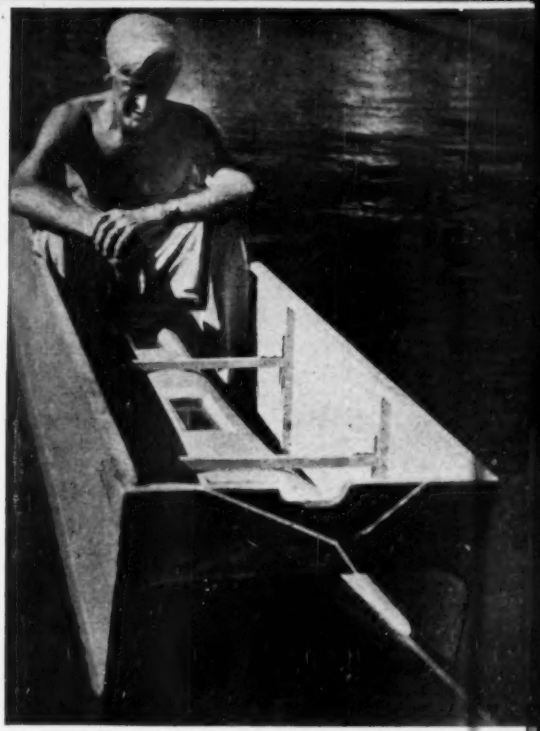
Weighing only 128 tons, the *Venturi* draws less than nine feet of water over-all,

Head-on photo of 20-knot turn shows *Venturi* squarely upright in apparent defiance of centrifugal force, with the complete absence of heeling over that characterizes this novel design.





Evolution of Wood's design is seen above. He cut an ordinary hull in two, then transposed the halves as shown. Incurving stern (dotted lines) solved problem of making boat steerable.



Glass windows, set along top of tunnel between hulls, enable Gar Wood to study wave patterns set up by 10-foot model of his "tunnel boat" as it is towed through water at various speeds.

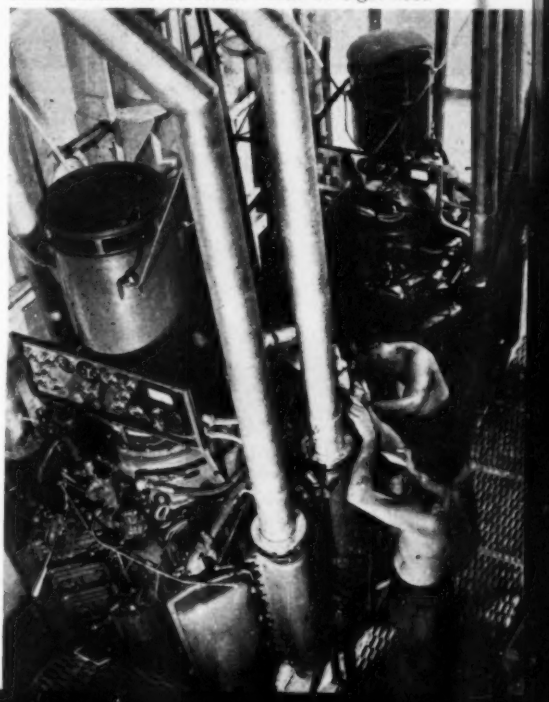
including propellers that project six feet below the hull. Hulls of mahogany plywood, thin but strong, contribute to its light weight and shallow draft.

What distinguishes the *Venturi* from all other catamarans or twin-hulled craft is the shape of its hulls. Outboard sides are ruler-straight except for an inward curve near the stern. Bowed-in tunnel sides give the hulls their maximum width, eight feet at the waterline and 12½ feet at the superstructure, two-thirds of the way aft.

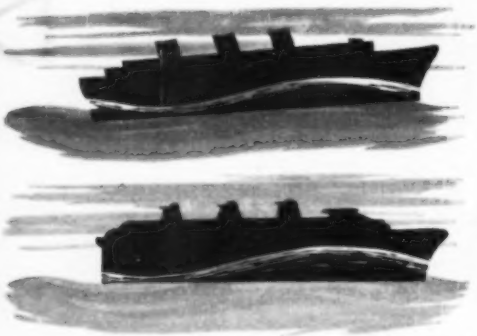
These streamlined hulls part the water with hardly more than a ripple—in striking contrast to the big bow and stern waves set up by most fast vessels. And scientific tests show that a conventional ship, at high speed, wastes most of its power in uselessly creating waves. Picturesque as it may be, a ship with a "bone in its teeth" is no marine designer's ideal!

The flat bottoms of the hulls slope gently downward from bow to stern, drawing 2½ feet of water forward and three feet aft when at rest. As the big ship gains speed, their planing action lifts it bodily, until they draw only six *inches* of water forward and

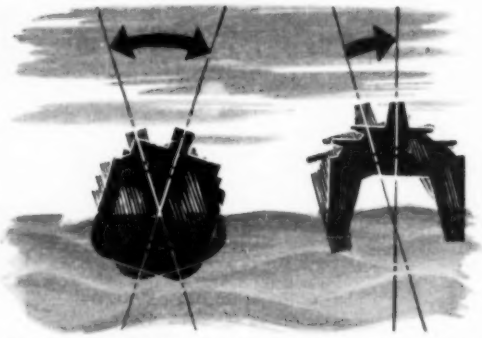
Port engine room shows two of *Venturi's* four 1,200-hp. Diesels. The craft's propulsion machinery is fitted in two narrow hulls, which reach maximum waterline width of eight feet.



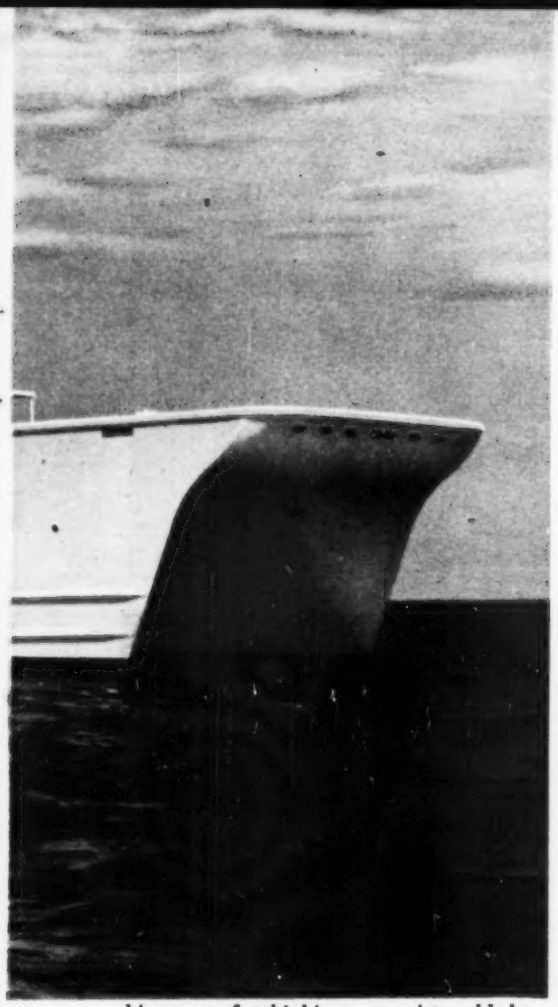
Is Gar Wood's 188-foot *Venturi*, above, the prototype of tomorrow's superliners? Some of



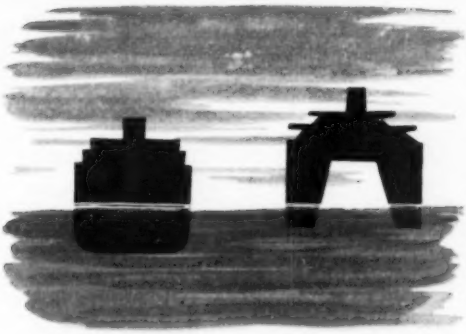
Instead of climbing *over* waves like standard hull, above, *Venturi*-type vessel below slices *through* them. This minimizes pitching, with its attendant discomfort and loss of speed.



Standard hull, a pushover to start rolling, then continues swaying like inverted pendulum. *Venturi*-type hull strongly resists rolling and, if forcibly tilted, promptly rights itself.



his reasons for thinking so are pictured below.



Shallow draft of lightweight *Venturi*-type ship, one reason for high speed, contrasts with submerged bulk of standard ships using huge power to push hole in water, pull in hole after them.

two to 2½ feet aft. By reducing submerged surface area, this cuts the "skin resistance"—frictional drag of water on the hull—that eats up power.

Pitching is eliminated because the narrow hulls slice *through* waves, instead of climbing over them. Wave crests roll along the sheer sides while the boat speeds ahead, undisturbed, on an even keel.

Instead of heeling over like an ordinary craft, the *Venturi* remains squarely upright, in full-rudder turns at high speed.

You need be no naval architect, versed in things like center of buoyancy and metacentric height, to see why it doesn't roll. Viewed end-on, the broad water-straddling footing of the *Venturi* reminds you of a man standing with legs widespread and braced, instead of balancing on one leg. Pacific islanders long ago proved the soundness of the principle with their seagoing outrigger canoes.

Under way, the *Venturi* becomes a mobile wind tunnel, whose squeezed-in sides resemble a Venturi tube and give the ship its name. At high speed, Wood foresees that the wind stream in the tunnel will act as a shock absorber, cushioning up-and-down motion of the boat and improving its steadiness. Systematic measurements to be made of air pressure and velocity in the tunnel will check its aerodynamic effects.

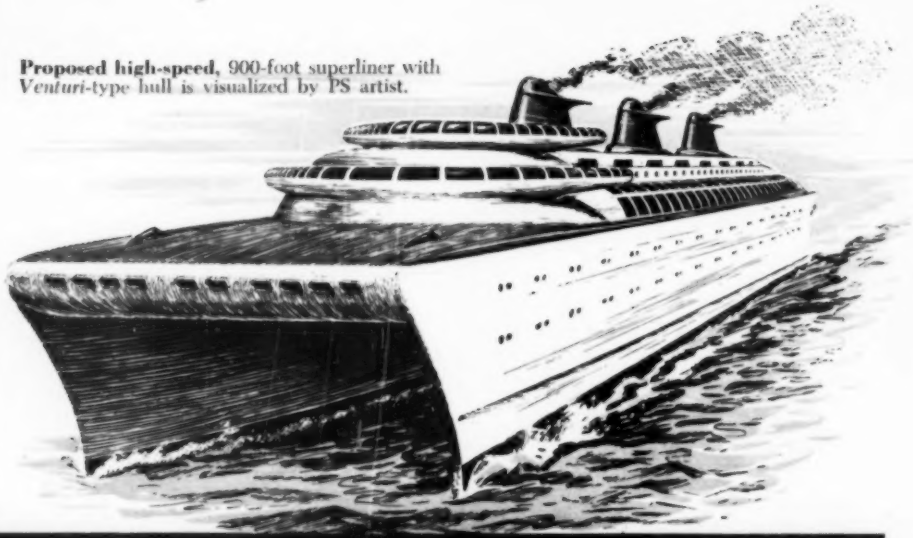
From Dump Trucks to Tunnel Ships

Though best known as a racing champion, Gar Wood has long been an inventor, and a highly successful one. He made his fortune, years ago, with his invention of the hydraulic lift for dump trucks.

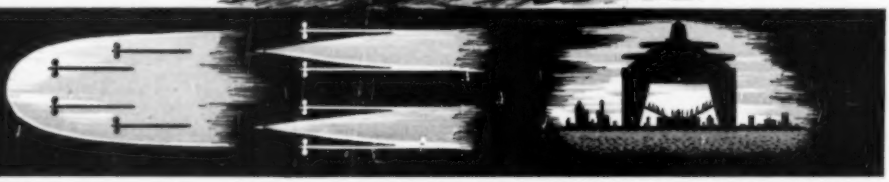
Since he retired undefeated from motorboat racing in 1933, he's been working on his tunnel-boat idea. It began with his curiosity about what makes a boat yaw, or veer from side to side.

Wood thought the bow was responsible. Others differed. So he built a motorboat that was practically nothing but bow, with a slender tail and rudder, shaped like a shoe tree. Veering crazily in try-outs, it dumped overboard all who tried to ride it. When the curved bow tipped even slightly, it acted as a rudder and yanked itself sideways, just as he'd surmised.

Could that same force be made to work the *opposite* way and hold a boat to its course? As Wood pondered how, it occurred to him to exchange the left- and right-hand sides of a boat. The result



Proposed high-speed, 900-foot superliner with *Venturi*-type hull is visualized by PS artist.



Twin-hull superliner design permits novel departure from conventional four-screw propeller arrangement shown at left above. Its steam turbines would drive four screws mounted abreast as at right.

If 160-foot beam is too wide for existing slips, superliner might be docked straddling special pier, using gangplanks on interior sides.

would be a twin-hulled craft. A sawed-in-two hull yielded a model so promising that larger ones followed.

At first, in fact, Wood was *too* successful. His straight-sided models held their course so firmly that they couldn't even be steered until he altered the outboard edge near the stern to an incurving shape that forms a basic part of his invention. With this incurve, the *Venturi* can turn in a radius of four times its length.

In 1944 the Army Air Forces commissioned Wood to build a full-sized tunnel boat to serve as a radio-controlled mobile target simulating an aircraft carrier. Called the *TA-1*, it was completed the same year, but Army plans had changed and it was never bombed. After the war the puzzled U. S. Maritime Commission sold it back to Wood as a "shelter for small boats." Wood removed protective armor, replaced gasoline engines with Diesels, and added cabins to convert it to a yacht. Relaunched last February at Miami Beach, the *TA-1* became the *Venturi*.

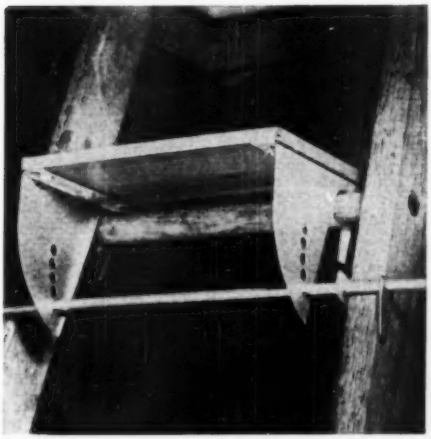
Is this experimental vessel the prototype of a practical liner? All its advantages, Wood maintains, will be retained when its dimensions are multiplied four times—length, a little more. He sees "tunnel ships" competing with ocean airlines, moving great numbers of passengers swiftly and economically.

Comparisons with existing ships must be made with reserve, for Gar Wood's is unique. No cargo carrier, it shares some of the problems of aviation design and economics. Strong but lightweight plastic replaces steel in construction to pare weight.

Problems remain to be solved—not the least of them, where to dock a liner of 160-foot beam, too wide for existing slips. Wood suggests a new transatlantic terminus at Montauk, on the seaward tip of Long Island—perhaps not too remote by land, considering time consumed in approaching and leaving New York by water. A more novel solution might be for the ship to straddle a pier of special design, and let down gangplanks from its interior! Whatever criticisms others may have of Gar Wood's ideas, no one can ever accuse him of being inhibited by precedent. END

Wing Trimmer Pares Pounds

THIS huge machine "sculptures" aircraft wings with the accuracy of a jeweler's lathe. Its job is to whittle off weight where the load in flight will be lowest. As much as 16 lb. are saved on each wing skin of an F-86 jet fighter. Operator at right manipulates an electronic switch panel and guides a pointer at his left along a pattern. This controls the "knife" in center that does the cutting. The Hypro® planer was developed by the Cincinnati Milling Machine Co., and North American Aviation.

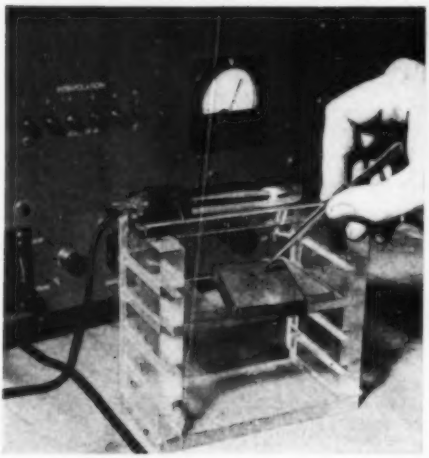


Ladder Step Is Platform

DOING an overhead painting or repair job need no longer be a balancing act. The platform step shown above is adjustable to fit any size ladder. Made of sturdy plywood, 7 by 11 inches, it is bolted to steel sides that slip over a ladder rung at any desired height and can be attached without the aid of tools. Called Add-A-Step®, it is made by the Machinery Sales and Equipment Co., of Cincinnati, and sells for $3.75.

Damp Basement Air Dried

CELLAR workshops or rumpus rooms can now be kept as dry as toast. The Frigidaire electric dehumidifier above protects lumber and equipment in a home wood-working shop. A fan draws the moist air over a series of cold coils, drying it by condensing the moisture into drops that drip into a drain. The device can be plugged into any outlet.



Isotope Spies on Rust

WITH the aid of an isotope—radioactive iron—GE scientists are now studying how and where rust starts and how deep it goes. Radioactive iron in a solution is electroplated onto another metal. Placed against a photographic plate, this coated surface makes an X-ray exposure. Where rust starts, the radiation decreases, leaving on the plate lighter areas that map the corrosion.

Above, the tweezers point to rust on metal under study. Just above it a Geiger counter checks the coating's radioactivity.

Prune Picker Lies Down on Job

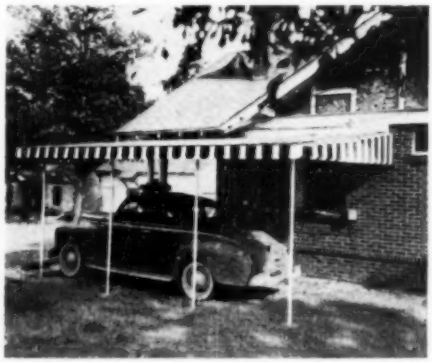
IT HAS always been back-breaking work to pick prune plums from the ground—and that set Albert Aff, Redwood City, Calif., to thinking. Why not do it an easier way?

Here's what he came up with. The operator, lying face down on a cushioned bed, picks up the fruit, places it on a conveyer belt that empties into a bin on the machine. One foot rests against a pedal that swings his bed in a wide arc. A 1½-hp. gas engine propels the machine, swings the bed, and runs the belt at the will of the operator.

Roofs Cheaper by the Dozen

MASS production has finally hit house roofs. At a big housing development in California, a 90-man crew applies 25 roofs a day with a fork lift and pallet system.

Fork lifts remove pallet loads of asbestos roofing from trucks, carry them to each site, and hoist them to roof level—and a six-man crew rides right up to the rafters with them. The 10-ft. reach of the fork lifts limits the system to one-story homes. The 90-man crew is broken up into highly specialized teams.

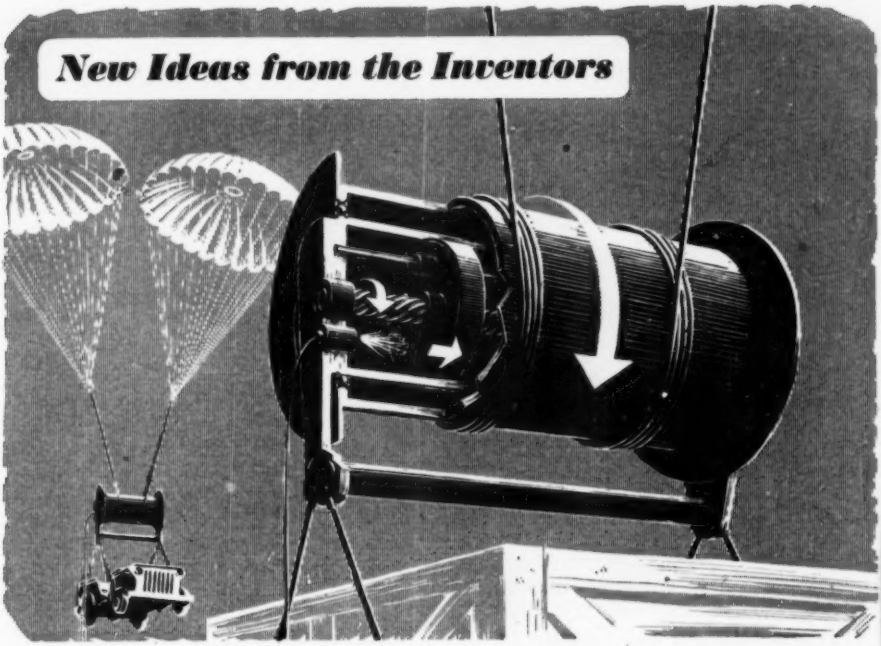


Car Port Subs for Garage

IF YOUR new house lacks a garage, a car port like the above can help make up for it, especially if your winters are mild. Shown is an aluminum awning made by Kool-Vent Metal Awning Corp., Pittsburgh. It is finished with a high-gloss enamel in either stripes or solid colors.

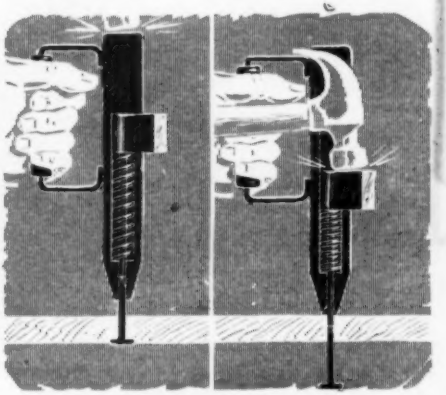
If you plan to build a garage eventually, the awning will serve temporarily. Later, when you have the garage, it still will give a sheltered unloading area for rainy days.

New Ideas from the Inventors



1 'Chute to Break Fall. When this parachute nears the ground, its cargo automatically winds itself up the ropes, slowing the fall and cushioning the landing. It is triggered by a weighted rope dangling below the cargo. When this strikes the ground and goes slack, it releases compressed gas from a cartridge. The gas pushes a piston along a spiral shaft, turning it. The shaft in turn rotates the winding drum.

2 Tree Guide to Aid Trimming. Trimming small lawn trees would be simple with this guide. A fork on the lower arm slips around the trunk, which acts as a pivot, while the upright arm can be adjusted to the proper angle. Swinging the guide around the tree then shows just where and how much to snip for an even trim all around.



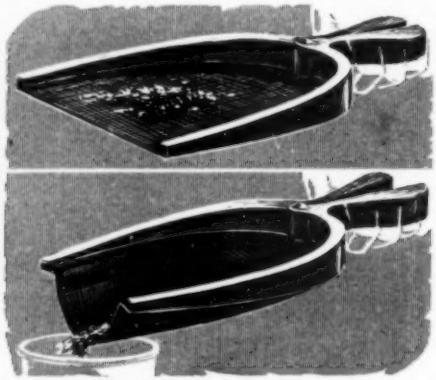
3 Tool to Remove Nails. You could take nails out of old lumber easily with this device. First slip it over the nail point and drive it down until it stops against the wood. Then hammer the arm at the side. This forces a rod inside the tool down against the nail point and through the hole until the nail is pushed out backward.

Turn the Page for Three More New Ideas

MORE New Ideas from the Inventors

4 Hobbyhorse to Gallop. Playroom rough riders would get an added touch of realism from this hobbyhorse. It not only bounces but moves its legs like a real galloping horse. As it springs up and down, a rod attached to the base moves rods pivoted at the sides under the saddle. These in turn move rods connected to the upper and lower parts of each leg so that the legs move back and forth in unison with each bounce.

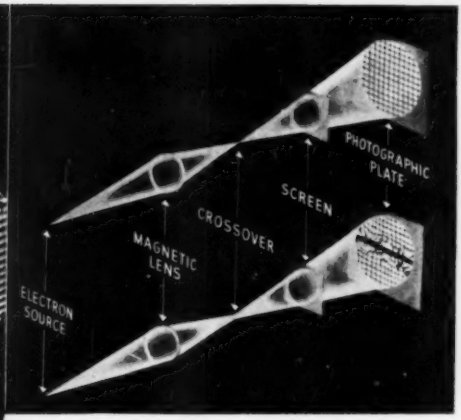
5 Lights to Show Car Speed. This row of tiny taillights would tell at a glance whether a car was speeding up or slowing down. Independent of the brake light, the lights are connected to the accelerator pedal. As the pedal is pushed down, they go on one after another to indicate speeding up; as it is released, they go off.



6 Dustpan to Fold Up. When you squeeze together the handle on this dustpan, its flexible bottom stretches taut for scooping up dirt. Then, for emptying, you simply spread apart the handle and the hinged side pieces swing inward, letting the bottom fold into a trough for easy funneling of the pan's contents into a narrow receptacle.

Patents on these inventions have been granted to: 1. P. V. Smith, Pacific Beach, Calif.; 2. A. I. Beets, Lansing, Mich.; 3. J. E. Brady, Dallas, Tex.; 4. W. P. Dwyer, Kansas City, Mo.; 5. M. L. Centrella, Philadelphia, Pa.; 6. P. W. Johnson, San Mateo, Calif.

Magnetic field around horseshoe magnet is traced in distorted shadow lines of fine screen photographed through electron microscope.



How it's done: Schematic drawings show how shadow of screen on film is distorted (lower sketch) by magnetic wire in electron beam.

Horizontal electron microscope is used by Dr. L. L. Marton, of National Bureau of Standards, to form visual images of magnetic fields.

Magnetism Poses for Photo

THE National Bureau of Standards has a brand-new tool for measuring and mapping magnetic fields. From it may come better radio and television and new knowledge about what makes metals magnetic.

The tool is nothing but a shadow. This shadow is cast by a fine screen of non-magnetic wire on a photographic plate in an electron microscope. Instead of light rays, the electron microscope uses a beam of electrons and focuses them through doughnut-shaped magnets instead of optical lenses.

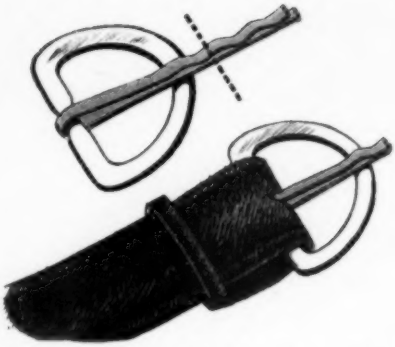
When you thrust an extra magnet into the beam, some of the electrons are deflected from their straight-line path. Result: distortion of the shadow of the wire screen. The effect is like looking at a stick thrust partly into water; the stick appears bent because some of the light rays from it are bent by the water.

Distortion of the image in the microscope is greatest where it is formed by those electrons that have been deflected farthest. Thus the bent crosshatching of the shadow forms a pattern that corresponds to the strength of the magnetic field under examination. Formulas have been worked out for calculating from this the absolute field strength of any magnetic material put under the microscope.

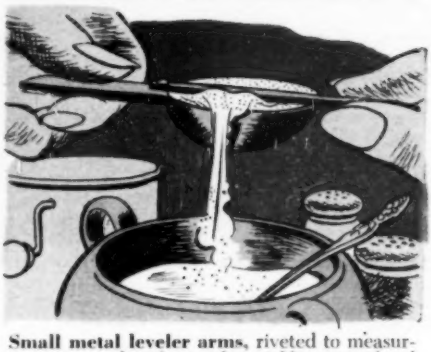
The Bureau of Standards' new method can be used, for example, to explore the magnetic fields of waveguides in ultra-high-frequency radio and television apparatus. These are traffic directors—the electronic plumbing that replaces wires, resistors, condensers, and inductors. Waveguide patterns become so complicated that there are no ways of calculating the energy distribution at critical points. Now it can be measured by electron shadowgraphs. END

Keeping the Home Shipshape

Dress up flower arrangements in clear glass vases or bowls by adding a few drops of cake coloring to the water. Choose a shade that matches or contrasts with the flowers.



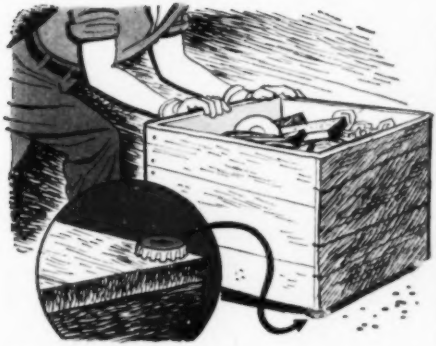
If you lose the tongue of a buckle, replace it temporarily with a bobby pin. Take off the buckle, fit the bobby pin to the crossbar, and cut it short. Then replace the buckle.



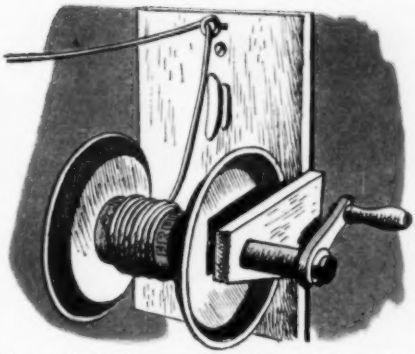
Small metal leveler arms, riveted to measuring spoons, let the cook quickly get a level measure. The arms swing out of the way along the handle when the spoons are being filled.

To keep ant poison from pets, put it in a bottle cap that's shielded by a jar top. Support the shield by nailing it to a vertical sidepiece, or to the baseboard.

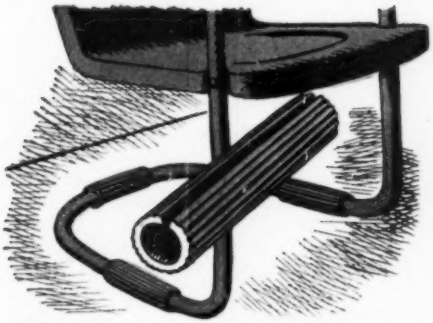
Chicken wire, stretched tightly across a box and stapled, makes a simple cleaner for dust mops. Rub and beat the mop on the wire. Dirt and lint will fall into the box.



It's easier to slide heavy storage boxes if you tack four or more bottle caps to the base of the box. The caps raise the box and reduce friction between it and the floor.



For a clothesline reel, solder pie tins to the ends of a tin can. Punch ½" holes in the center at both ends. Run a ½" dowel through and secure it with screws through the can.



Rubber bumpers, cut from old garden hose, prevent tubular-metal chairs from marring floors. The elasticity of the slit hose will keep it in place, but it may be wrapped with tape.

The tabs of unstarched collars can be kept neat and straight with hairpins and adhesive tape. Stick pins and tape to the underside. The stiffeners can be removed easily.

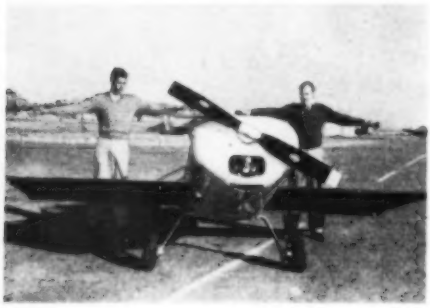
Notebooks or books of plans that you're working from will stay open at the right page if you'll use a pair of spring clamps, as shown above, with a length of dowel inserted between them.

Tank Car Fuels Jet Bomber

A SINGLE fueling point under the fuselage of this North American four-jet B-45 feeds into all the plane's internal tanks. The result is that whereas it used to take four hours for the Tornado to drink its fuel, the job now can be done in half an hour—and directly from a tank car at airfields. The system also will permit faster air-to-air refueling to extend the 800-mile tactical range of the Air Force's powerful jet bomber.

Rear Mirror Widens View

THE motorist above is getting a clear view of both sides of the road as well as directly behind. It's done with five 2- by 7-inch non-glare mirrors fitted into a metal frame at various angles to cover a 160° arc. The Wyd-Vue®, seen in place across the top of the windshield, is made by the Am-Ben Corp., Chicago. It sells for $7.50.



Midget Made at Home

WITH hands joined, Paul Holmes and Merle Larson, of California, show that they can almost reach across the 13 feet between wing tips of the tiny plane they designed and built without the assistance of aviation engineers. A few hours after it was assembled, Larson climbed into the cockpit for taxi tests. So well did it behave that he surprised his partner by taking off and putting the midget through its paces. An 85-hp. engine powers the miniature racing plane.

"Wrung out" on the frame twister, this 12-ton 8x8 shows the new look in Army trucks.

Army Breeds New Line of Combat Workhorses

To cut driver fatigue, new trucks are to have torque converters, huskier engines, and torsion-bar suspension.

By John F. Loosbrock

PS photos by W. W. Morris

CLIMB in, settle yourself behind the steering wheel. Flip the starter switch on the dashboard. Don't look for the choke—it's an automatic one, under the hood. Your left foot will fumble for the clutch pedal until you realize it isn't there. Just pull the control lever on the steering column down into high, step on the gas, and you're off—it's that easy.

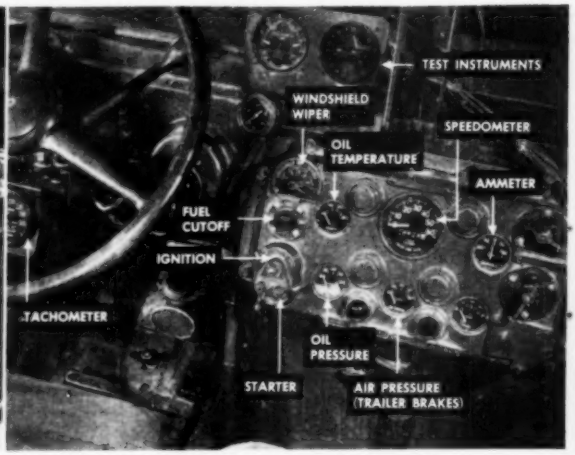
And while you're rolling along, reflect on this fact: you're driving not a luxurious new automobile, but a rugged 2½-ton Army truck, lineal descendant of the workhorse of World War II.

GI drivers who pounded down the Red Ball highways in France or over the coral roads on the Pacific islands wouldn't even recognize the new bloodlines that Army Ordnance vehicle experts are now breeding. I know I didn't when PS photographer Bill Morris and I visited Aberdeen Prov-

Test model 2½-ton, top, bears faint resemblance to its wartime brother. Close-up shows tire-pressure controls. Each tire has own control. Master knob (arrow) turns system on and off.

Wide doors and plenty of clearance under steering wheel make new trucks easy to get into. More important, as combat drivers will testify, they're easy to get out of in a hurry.

Raised cover on ¾-ton shows twin oil-bath air cleaners and power winch. Fan mounted on engine sucks in cooling air through grille atop hood. Lamp above headlight is for blackouts.

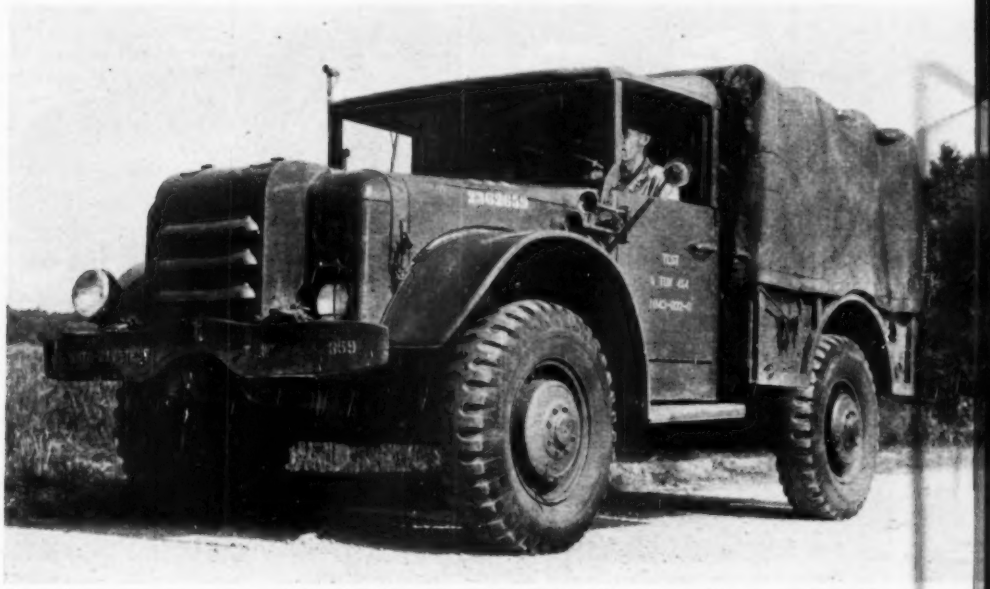


Dashboard of ¾-ton 6x6. Note the transmission-control lever on the steering column, new on military vehicles. Instruments mounted above and left of dash are for test purposes only.

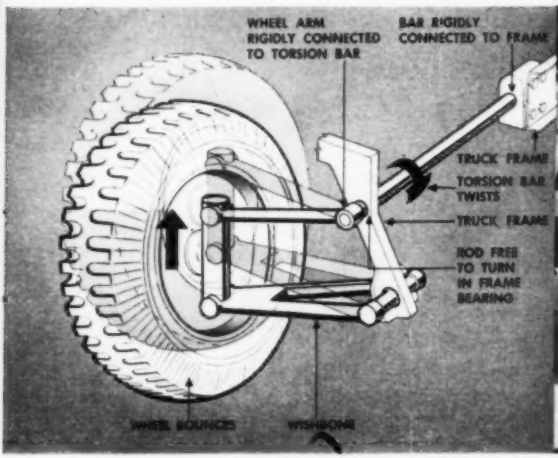
ing Ground, in Maryland, to see the test models put over the jumps.

The new jobs still have steering wheels, but any resemblance to conventional wartime trucks stops about there. Transmissions are automatic, with torque converters and planetary gear systems. That makes them easier to drive, with two sound military consequences: less driver fatigue when trucks are rolling day and night, and simplified driver training.

I hadn't driven a truck since I struggled with the intricacies of double clutching on a wartime 2½. Yet I climbed in one of the



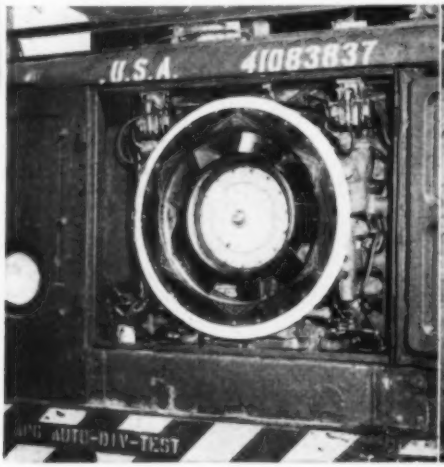
New ¾-ton cross-country truck has 187-hp. air-cooled engine, hits 60 m.p.h. on good road.



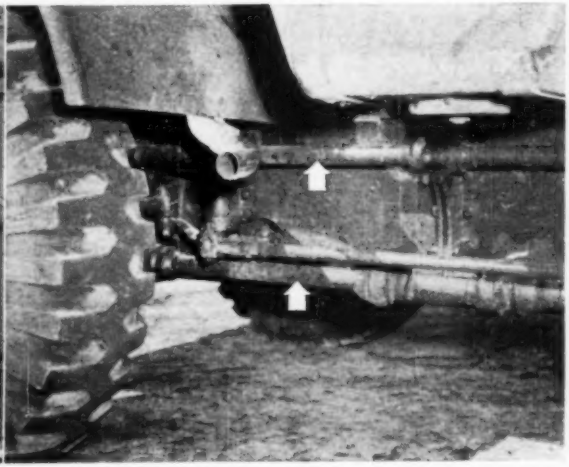
Here's how torsion-bar suspension works. When wheel passes over bump, linkage system twists bar, performing same function as conventional spring. Drawing is purely schematic.

Close-up of torsion bar (arrow) on front of ¾-ton. Bars are high-quality steel, polished to mirror-like smoothness. Nicks or dents act as focus for strains, so bar has protective wrapping.

This 5-ton 6x6 has air-cooled engine, torque-converter transmission. Middle set of wheels turns with front set, giving this 150-inch-wheel-base job a turning radius of only 35 feet.



A huge cooling fan replaces the conventional radiator. The engine has eight opposed cylinders and is mounted on end with a vertical crankshaft. It develops 200 horsepower.



Close-up shows torsion-bar suspension (arrows) on the 5-ton truck. Twisting action of top bar takes care of ordinary road shocks. Bottom bar does same job as conventional overload springs.

latest GI jobs and wheeled it over Aberdeen's tough Munson test course without so much as a dry run. It was actually easier to drive than a jeep. This means that, in an emergency, every soldier is a potential driver.

Engines are the new air-cooled type, developed and built by Continental for Ordnance. No more radiators to be punctured by shrapnel, or to freeze in the Arctic and boil dry in the desert. Engines are more powerful, although the absence of radiators allows them to be crammed into smaller spaces. The test model of the ¾-ton kicks out 187 hp. at 3,000 r.p.m., about double that of its wartime predecessor. The same engine powers the new 2½-ton, which differs from the ¾ only in a bigger cargo bed and an extra set of rear wheels.

Machines Cheaper Than Men

Torsion bars, like those on some of the new foreign cars, are replacing conventional spring suspension systems. They give a smoother ride with greater frame rigidity. Again, the idea is to lessen driver fatigue. Expensive as these new vehicles will be, our Army still holds to its theory that machines are easier to replace than men.

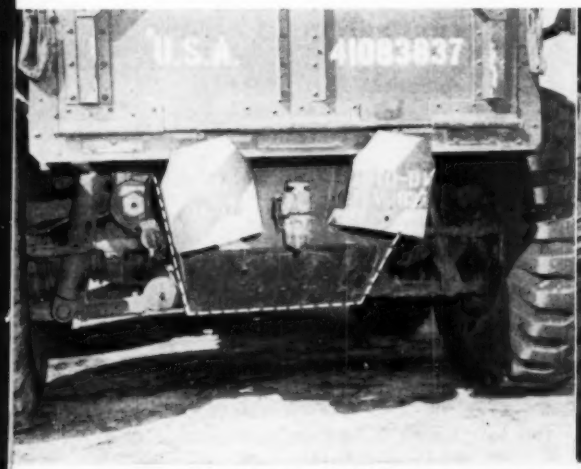
On some of the big jobs, more than one pair of wheels steer, either through a knuckle arrangement or by mounting them on a platform that turns. They have hydraulic-assisted steering, so you can push a 25-ton tank retriever around a corner as easily as a jeep.

Tire pressures can be changed at will, merely by flipping a series of knobs on the dashboard. This will pay off primarily in amphibious operations. You can drive across a soft, sandy beach with tires at low pressures, and then pump them up when you hit firm ground—all without getting out of your cab.

Even the brakes are new, mounted outside instead of inside the wheel. To reline them, you just unscrew a few nuts and the drum slips off to expose the brake mechanism. Minor jobs, like bleeding a hydraulic line, can be done through a small inspection hatch, without pulling the drum. The arrangement is so simple and satisfactory that Ordnance experts shake their heads and wonder why someone didn't try it years ago.

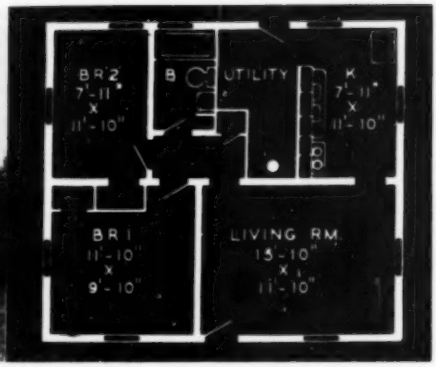
These startling new trucks aren't in quantity production, as the Ordnance Department is the first to point out. They are strictly development models, for test purposes only. Various frame types are being experimented with. Some engines are mounted vertically, some horizontally.

But hang the various new features of these 1949 Model Ts (their official Army model number is preceded by T, for Test) on one truck and you'll get an idea of how the GI combat vehicle of the future will look. To me it looks good. END



Rear view of 5-ton job shows new experimental frame resembling hull of a boat. Hull (outlined in white) gives great rigidity. Hanging wheels on hull eliminates rigid axle.

New sealed brakes are mounted in drum on outside of wheel for easy access. Brakes can be relined and adjusted without pulling wheel. Minor repairs can be made through opening.

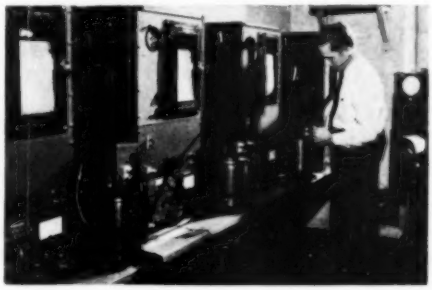


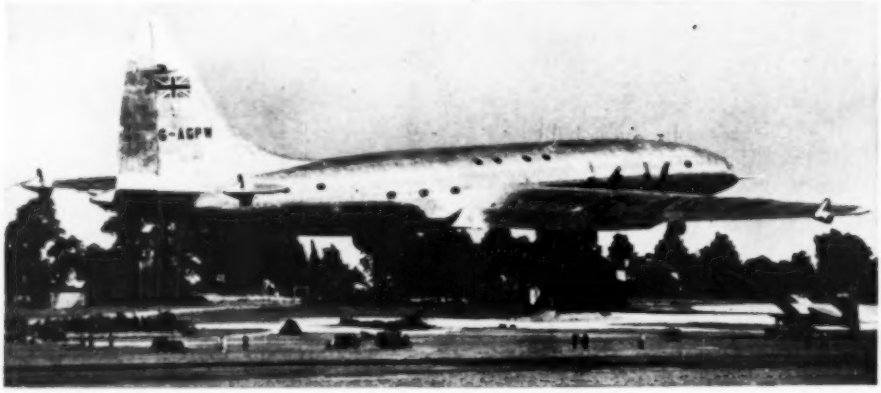
New Prefab Is Low in Cost

A NEW low-cost 4-room home on which the down payment is as low as $350 and the monthly payments $37 is being made by the U. S. Steel Corp. Total cost of the house, including landscaped plot, is under $6,300. It contains two bedrooms. This plywood-panel prefab is being turned out in New Albany, Ind., at a rate of one every 20 minutes. The company has made prefabs—called Gunnison Homes—for 15 years.

Trillionth of an Ounce Is a Lot

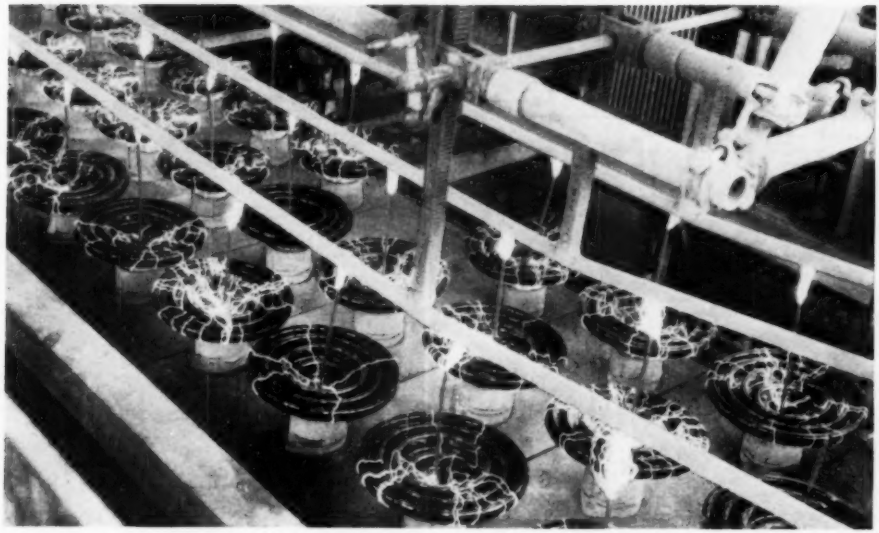
Even .000,000,000,000,03 ounce of radon gas is spotted by the measuring devices at right. They determine radon content—which tells how much radium is present, since radon is produced as radium decays—by measuring the radioactivity of samples in the metal cans. A fantastically small amount can be important to the Atomic Energy Commission's New Brunswick (N. J.) Laboratory, which tests materials for atomic work.





Biggest Landplane Flies

EIGHT-ENGINED Bristol Brabazon I, the largest landplane in the world, is shown above taking off on a test flight in England. Her length of 177 feet compares with 110 feet for the Boeing Stratocruiser and 182½ for Air Force's 6-engine C-99 cargo plane. Brabazon's gross weight exceeds C-99's 132½ tons, however, by some 10 tons.



"Spaghetti" Tests Insulators

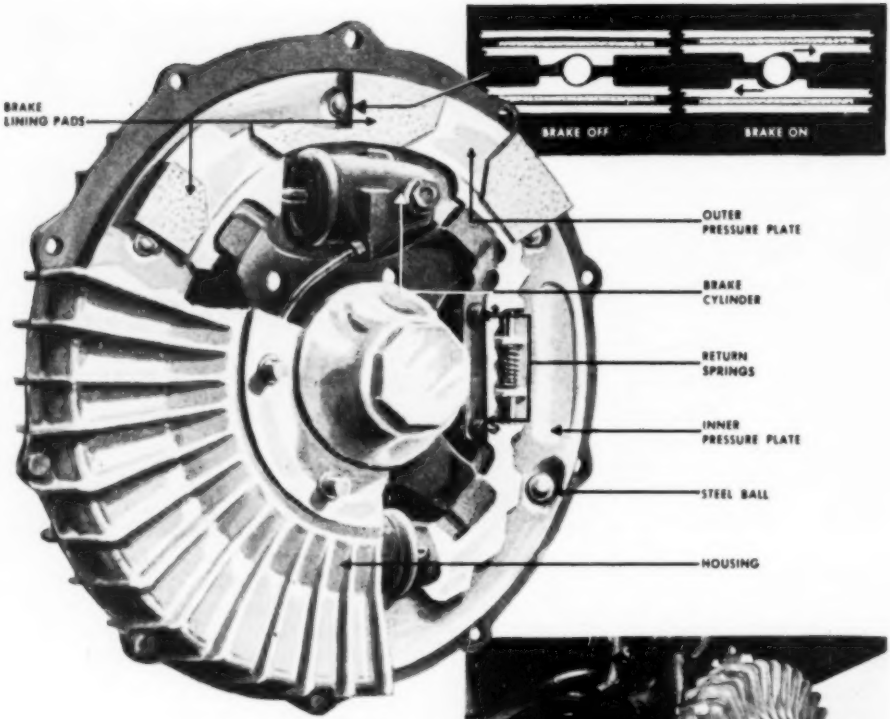
THE white threads crawling from these porcelain bowls are 90,000-volt arcs. The display is a Westinghouse test of power-line insulators. They ride a conveyer under conductor rods from which electricity jumps to vertical electrodes, then flashes over the insulators themselves. The barrage reveals any flaws in the porcelain.

Caboose Gets Bay Windows

THE little red car on the end of every freight train is losing its familiar cupola. Instead, this new caboose has a bay window projecting from each side. Seated there, a trainman can see the doors of cars ahead, and the side windows slide open to let him signal the engineer. The Southern Pacific is building 80 of the new cars.

B-29 Windbreak Stops Dust

WIND-BLOWN dust can play hob with an airplane engine when it's stripped down for repairs. Mechanics at Fairfield-Suisun AF Base, Calif., solved the problem with this king-size windbreak. It is 12 ft. 8 in. square. A leather boot at each corner fits over a B-29 propeller tip. Mechanics can work behind it and forget about dust.



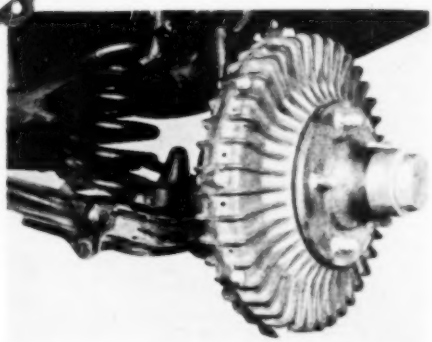
Chrysler Adopts New Disk Brake

ELIMINATION of those twin bogeymen of automobile braking—"fade" and loss of reserve—is claimed by the Chrysler Corp. for its new disk brake. Other advantages listed are less pedal pressure and automatic wear takeup.

"Fade" is what makes you have to press harder on the pedal when the linings get hot. Chrysler says its brakes won't fade because disk brakes lose heat faster, and because the lining area is greater.

Loss of reserve in conventional brakes can also come from heat—the drum expands away from the lining and the driver's foot has to travel farther. Chrysler says that any heat-caused expansion on its brake won't increase the lining-to-disk distance. No matter how much the disk expands radially, it won't get any farther from the lining.

Heart of the brake, adopted for Imperial models, is two 12-inch aluminum pressure plates with rings of lining bonded on them.



The finned outer housing of the new Chrysler disk brake gives rapid heat dissipation. Housing itself revolves with wheel. The company reports the design increases lining area 30 percent.

When you brake, these are forced outward against the inner walls of the housing, which turns with the wheel.

Six ⅞-in. steel balls, sandwiched in sockets between the plates, are what force them outward. When the brake pedal goes down, a hydraulic cylinder rotates these two plates slightly in relation to each other, rolling the balls out of their nests onto little ramps and spreading the plates apart. The brake is partially self-energizing, using some energy in the car's motion to reduce pedal pressure.

How to Shoot A 5-Ton Skyrocket

There's a lot of work for scientists on the ground before a supersonic research laboratory is zoomed skyward.

By Andrew R. Boone

TO STEAL secrets from space, the Navy's new Viking rockets hoist an automatic physics laboratory higher than any airplane has ever flown. A Viking makes only one flight and it's in the air only a few minutes. But since it must make a complete report of what it finds, those few minutes involve months of arduous preparation.

Radio does the reporting, as the Viking soars aloft at more than 1,700 m.p.h. A running case history on atmospheric pressure and temperature and data on solar and terrestrial radiations are sent over 30 channels. On the ground, 25 telescopes, cameras, "dopplers," and radars follow the missile to record its behavior and report its position.

For photographing cloud formations and the earth from high altitude, the Viking carries two movie cameras in its tail and two still cameras in the nose. The physical recovery of these cameras presents a problem. It has been figured out that if the rocket were to hurtle back in its original shape from a 100-mile height, it would hit the earth with an impact of thirty 80-ton

A Viking rocket "blows off" liquid oxygen while being prepared for a sky flight. Its job is research. This is one of ten Vikings to be built for the Navy by Glenn L. Martin Co.

locomotives smashing into a wall at 60 miles an hour. One solution is to blow off the nose by a radio-triggered explosive charge as it descends. The unstreamlined parts then tumble end over end, landing slowly enough to permit instrument recovery.

Compared to the German V-2 rocket, the Viking is small and thin. The second missile of the type was 46½ feet long and 32 inches in diameter. It weighed 9,800 pounds and carried a 1,500-pound payload. Unlike the internally braced V-2, the Viking's strength is in its aluminum skin. The rocket rises slowly in the lower atmosphere, accelerating rapidly in the 60 seconds before the fuels burn out. Peak thrust is 23,000 pounds, about a third that of the V-2.

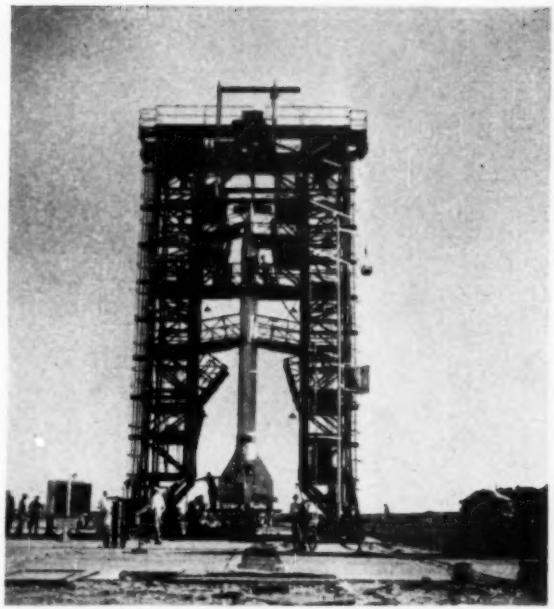
With new rocket motors, Navy scientists hope a future Viking will get up to 200 miles. To reach that altitude, it would have to hit a speed of 5,800 miles an hour. If it could keep going at that speed, it would reach the moon in 41½ hours. The first Viking launched reached 51½ miles, and a speed of 2,250 miles an hour. The second, shown in these pictures, turned downward at 33 miles.

Viking an Alcoholic

The Viking's fuel is primarily alcohol with oxygen added to allow combustion. The fuel is forced into a combustion chamber by two pumps operated by a steam turbine. The latter is turned by the decomposition of hydrogen peroxide into water, hydrogen, and oxygen. The rocket is stabilized in flight by a new gyro-controlled system in which pitch and yaw are corrected by swinging the entire motor. Exhaust steam valved through the fins corrects any roll, with an assist from small trim tabs. When the propellants and steam have been exhausted, the nitrogen that pressurized the propellants before the turbine and pumps took over stabilizes the missile.

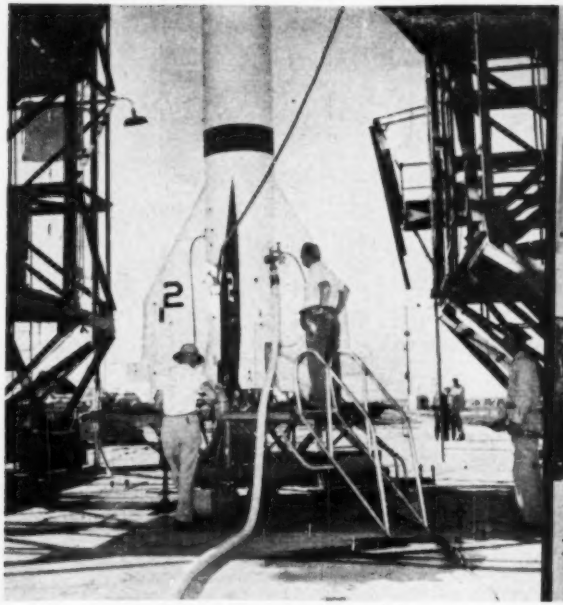
Rockets have a way of getting out of bounds. One straying V-2 crashed in a Mexican graveyard, 40 miles away. If a Viking shows signs of wandering off the rocket reservation, a radio impulse can be sent out to cut the fuel and end the flight.

The first U. S. rocket built to explore the upper atmosphere, the Viking is essentially a mobile research tool. Two of the $300,000 skyrockets have already been launched from the White Sands Proving Ground in New Mexico. How the experts fire them and keep them under close scrutiny is shown in the photographs on these pages. END

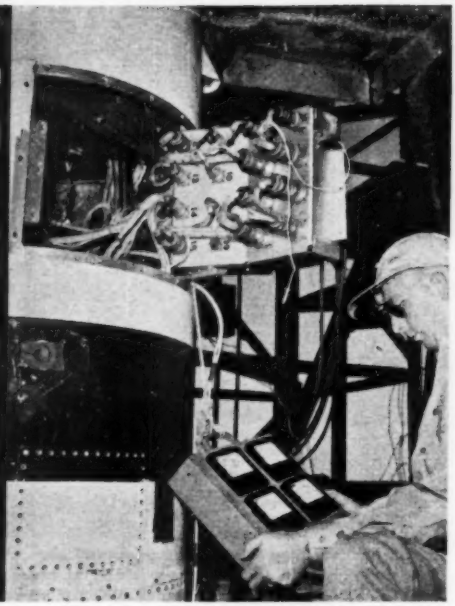


1 **Huge steel gantry** provides a working platform for Navy scientists as they adjust instruments and fuel the Viking. It is rolled away on rails before the big rocket is fired.

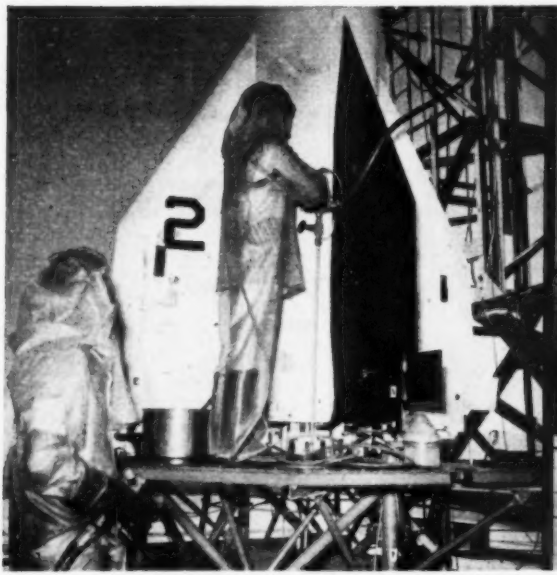
4 **Delivering the 270-pound charge** of 90-percent pure peroxide is a dangerous job. Workers transferring the drums to gantry crane wear protective suits and double rubber gloves.



2 **While others are busy** aloft on the gantry, technicians check adjustments at the rocket's base. Man standing on platform is inspecting valves of the Viking's alcohol feed line.



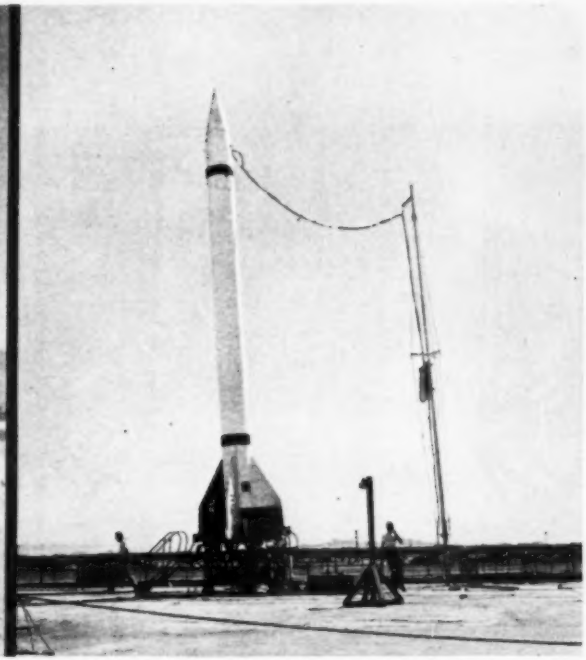
3 **Meter readings** are taken to test all electrical circuits. Mounted on a door that forms part of the missile's skin, this connection center is located near mid-point of the rocket.



5 **Also dressed in protective suit,** technician charges the rocket with peroxide. Fireman at left is standing by, ready to douse him quickly in case some of the chemical should spill.

6 **Gantry is rolled away** as rocket is readied for firing. One of the last jobs is being done by the refrigerator truck at left, which is pumping in 3,700 pounds of liquid oxygen.

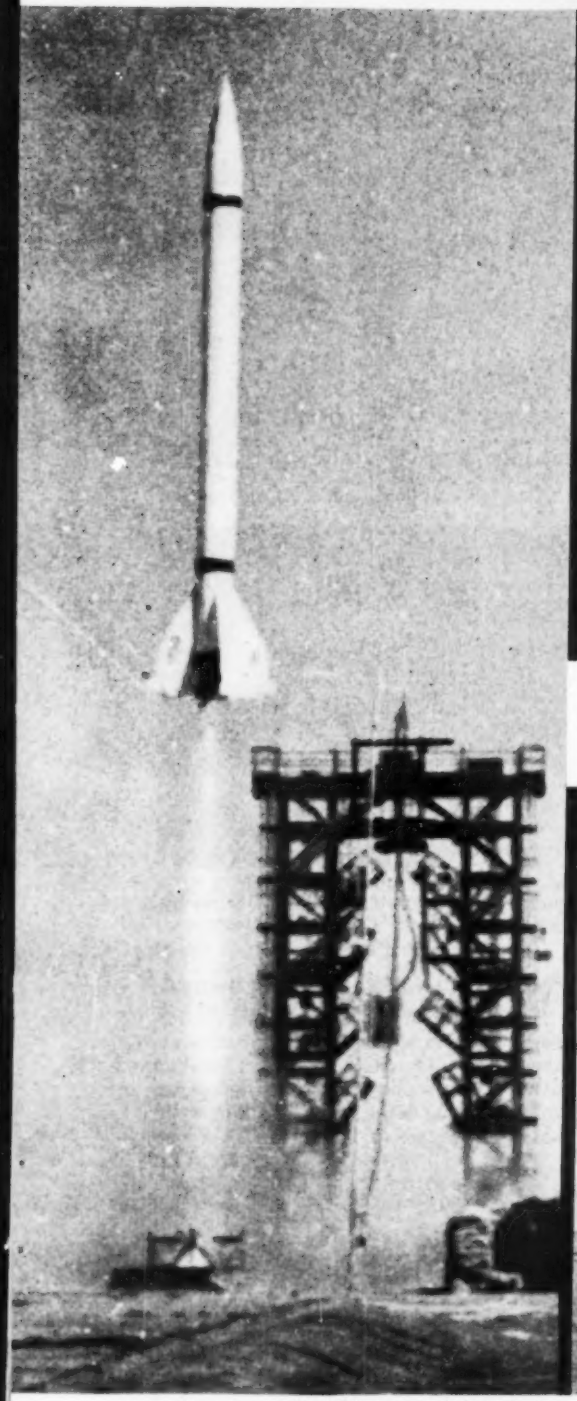
7 Electrically operated "firecrackers" on a stick will ignite Viking's gas mixture. In less than a second rocket takes off. Cords lash assembly's plywood base to rocket understructure.

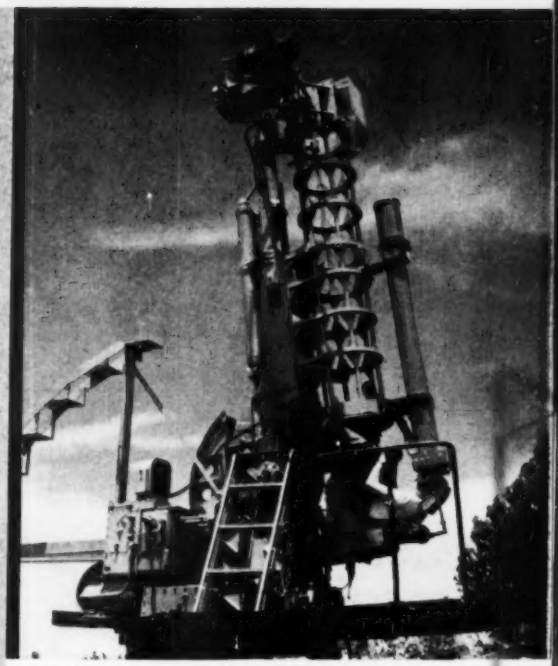


8 Ready for launching, the rocket is cocked 3° from vertical. The thin mast at right, carrying nitrogen and electrical circuits, drops away several seconds before rocket is fired.

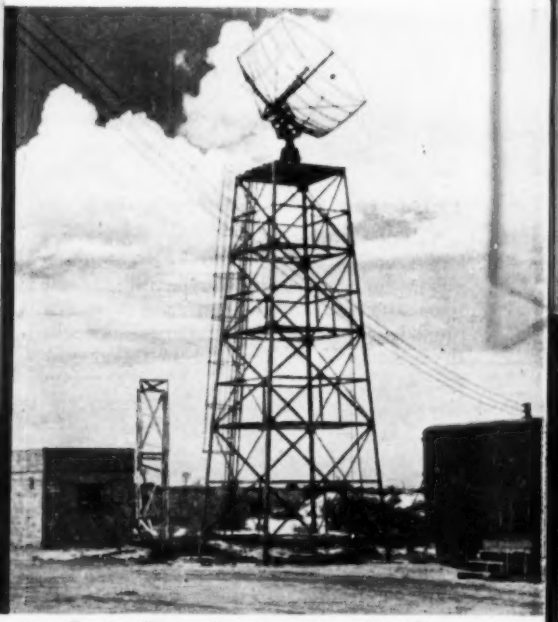
9 Fifteen minutes before launching, a red flare is shot off near the observation blockhouse, seen in the background, to alert trackers who do not have radio communication.

10 The man who shoots the big rocket is this Navy officer. Peering through a slot in blockhouse, he watches preparations, and, when all is ready, presses the firing button.





12 Keeping an eagle eye on the Viking in flight is the job of "Popeye" the telescope (PS, Jan. '48, p. 129), located 8,100 feet atop Mule Peak, 40 miles from the launching site.



11 Up we go. The Viking soars aloft in deafening roar of exhaust gases. While this one went up only 33 miles in a recent launching, the Navy is aiming at a goal of 200 miles.

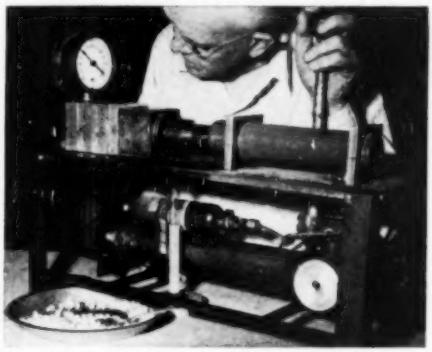
13 Station Viking broadcasting. This telemetering antenna picks up the rocket's messages on conditions aloft, automatically sent out over 30 channels during flight.

Consistometer measures stickiness of creamed corn by showing how far a can of it spreads when dumped on plate ruled off in circles.

Stringiness gauge records how much pressure is needed to cut through a string bean. That helps to tell how long canner should cook it.

Precise Machines Test Canned Food for You

THESE pictures show three of the mechanical food testers developed at the University of Maryland. They are used in research to help farmers and canners in thirteen Eastern states improve their methods. Another, not shown, determines the ripeness of fruit by measuring its color photoelectrically. About the only quality the machines can't gauge is flavor. For that, the university still employs a panel of human tasters. Still, admits Dr. A. Kramer, director of the research project, "The people who buy the stuff are the ones who know best."



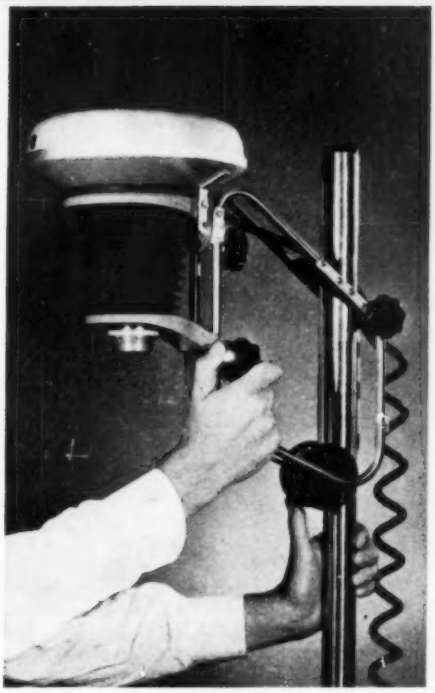
Succulometer measures how much juice is squeezed out of 100 grams of corn when hydraulic press subjects it to 500-lb. pressure.

Trimotor Gets Glider's Job

THE new three-engine Northrop C-125 below—the Raider—will replace Air Force gliders for establishing "air heads" and for Arctic rescues. Full-span flaps and reversible props let it operate from unimproved fields. It can carry 32 soldiers and their gear.

Phones Use Prefab Exchange

To speed expansion of telephone service, Australians are building automatic exchanges on an assembly line and sending them out on trailers, as shown below, to rural towns. As lines are strung they need only to be plugged to the exchange.



Enlarger Diffuses Light

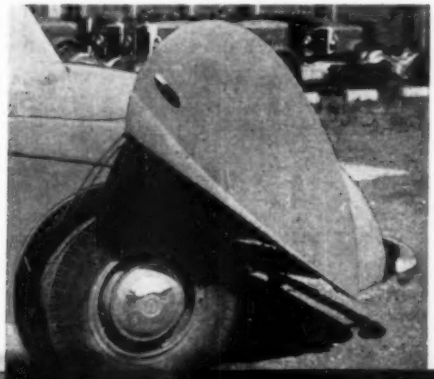
THIS new type of photographic enlarger uses an "integrating sphere" as a light source. The sphere, coated with a special, highly reflective white paint, encloses a "cold light" bulb. The paint catches its rays and re-reflects them until the light is evenly distributed. Made by Eastman Kodak, the Hobbyist®, is said to combine the good diffusion of enlargers employing diffusion glass, and the speed and contrast of condenser types.

Pilot's Radio Lights Airport

THE pilot of an airplane who needs runway lights turned on for a landing at an untended airport can do it himself if the lighting system works like the one at the field in Bellflower, Calif. He needs only to press his regular communication microphone button seven times. On flash the lights. A radio receiver on the ground responds to the standard aircraft 3105-kc. frequency, switching on the lights for a preset interval.

Auto Fender Flips Up

WHEN a rear tire must be changed on this British car, you release a catch and the entire fender flips up out of the way. A counterweight holds it up until it's pushed down and locked. The convertible body that carries the trick fender was built by Hooper & Co. for use on a Daimler chassis. The release catch can be seen on the fender's side.



Canada Builds Jet Air Liner

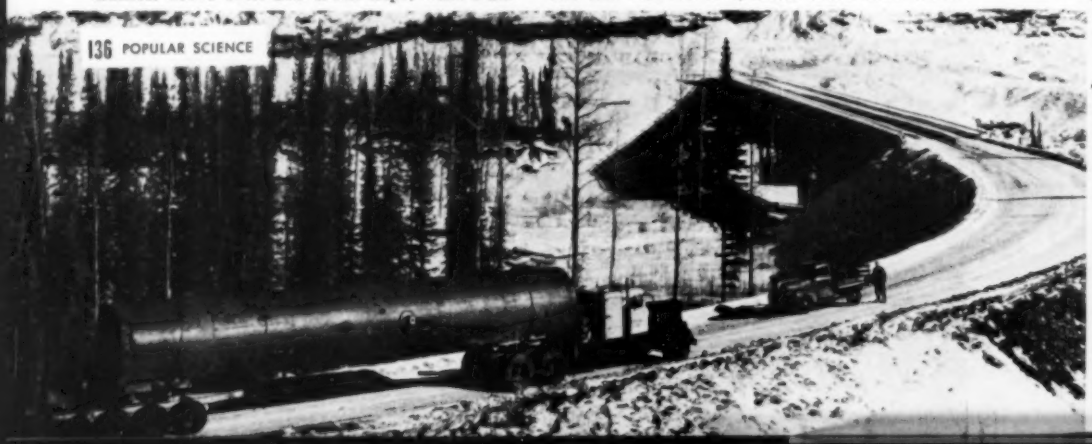
THIS Canadian-built Avro jet air liner is the British Commonwealth's second jet transport announced recently. The other is the de Havilland Comet (PS, Oct. '49, p. 152). The Avro is built to carry 36 to 40 passengers at 400 m.p.h. at a 30,000-ft. altitude on medium-range domestic routes. Cabin pressure simulates 4,000 ft.

1 **This war-surplus refinery** at Whitehorse was uprooted and moved 1,414 miles by truck and rail to Edmonton. Truck in the foreground is starting long haul. Map shows route.

Refinery Takes Truck Trek Across Subarctic

THESE pictures show one of the biggest moving jobs in history. When oil was discovered in Edmonton, Canada, in 1947, a refinery was needed. It would have taken at least three years to build one. But at Whitehorse, nearly 1,500 miles to the north, stood an abandoned wartime refinery. Imperial Oil did some figuring and gambled on the Arctic weather. In 18 months, 7,000 tons of tanks, towers, boilers, furnaces, and tubing were trucked 919 miles over the Alaska Highway to Dawson Creek, shipped by rail 495 miles more to Edmonton, and reassembled. Cost: $1,000,000 for the refinery, $7,000,000 to move it—still cheap, say the oilmen, considering the time saved.

6 **Along Alaska Highway,** a 20-ton Diesel truck hauls refinery tower section on two trailers. Move took 200 truck trips, with loads up to 40 tons, between Whitehorse and railhead at Dawson Creek. Original schedule for 919 mi. was 50 hrs.; some loads took weeks.



2 **One of major dismantling jobs** was lowering giant 146-foot refinery tower intact. Superstructure had been removed previously.

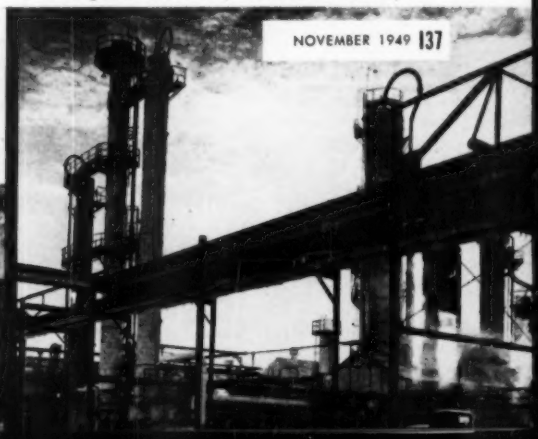
3 **As the tower,** held between steel rigging poles, nears the horizontal, workmen build up timber trestles to support "can" on ground.

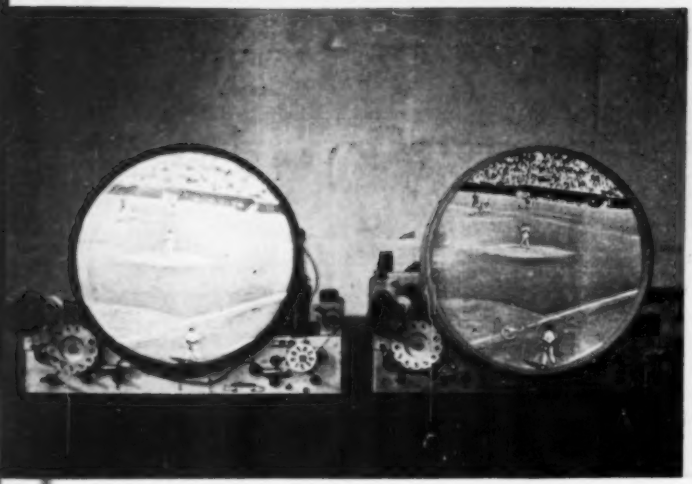
4 **A huge condenser,** being lowered by a crane, is maneuvered into a clearing where it was broken down for easier truck loading.

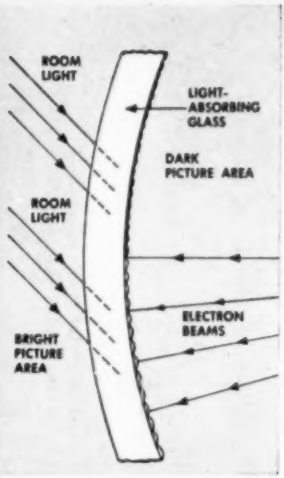
5 **This log-cabin-like structure** is a furnace being dismantled. Workman at top is one of many Yukon Indians engaged on the project.

7 **Using steam,** driver cleans frozen mud and ice from trailer. Rolling through two winters, the trucks covered 400,000 miles.

8 **End of a journey.** Towers that once were Whitehorse landmark today cast shadows over Imperial Oil's busy Edmonton refinery.







New Glass Sharpens TV Pictures, Cuts Glare

A NEW light-absorbing glass on the front of television tubes sharpens the pictures by soaking up room light instead of reflecting it from the viewing screen.

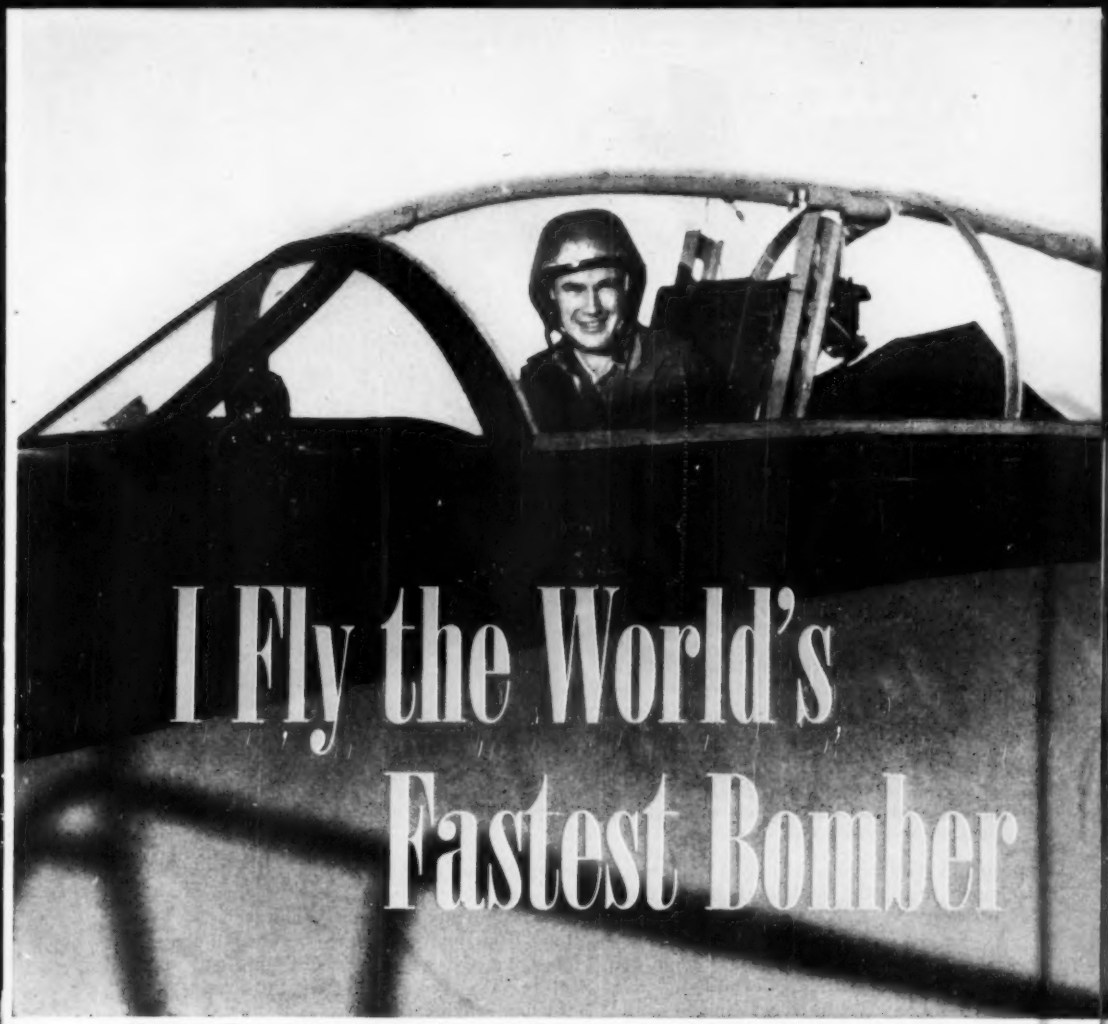
You can see the difference in the photo above. It shows the image on a tube surfaced with the new glass (right) alongside the image on a conventional tube receiving the same picture on the same type of set.

Darker than ordinary glass, the Teleglas® acts much the same as a dark filter. As shown in the sketch at right above, room light would have to pass through the filter twice to be reflected from the tube. Light from the tube, forming the picture, is filtered only once—and so is comparatively much brighter. The filter also suppresses "halation" or light reflection from within the tube that decreases picture contrast.

The filter glass is made by Pittsburgh Plate Glass Co. and is used on metal-shell tubes in the new line of Zenith receivers. It is said to let you see comfortably under varying room illumination and to reduce eye strain by producing pictures of good contrast without excessive brightness and glare.

Light Lifeboat Carries 12 Men

THE Coast Guard has adopted a rubber abandon-ship boat that one husky man can toss overboard. It weighs 186 lb., with survival gear, and folds into the 4-foot package shown at right. Pulling a rip cord unzips the cover and triggers gas cartridges that inflate it in 30 seconds to 14 feet long and 6 feet wide. The craft, made by B. F. Goodrich Co., then seats 12 men and can support 13 more clinging to the side. Two of its four wooden paddles form a mast to support a nylon canopy.



I Fly the World's Fastest Bomber

Test pilot Fraser sits in Stratojet's commodious front cockpit, ready for rocket-boost take-off.

By Jim Fraser, *test pilot*

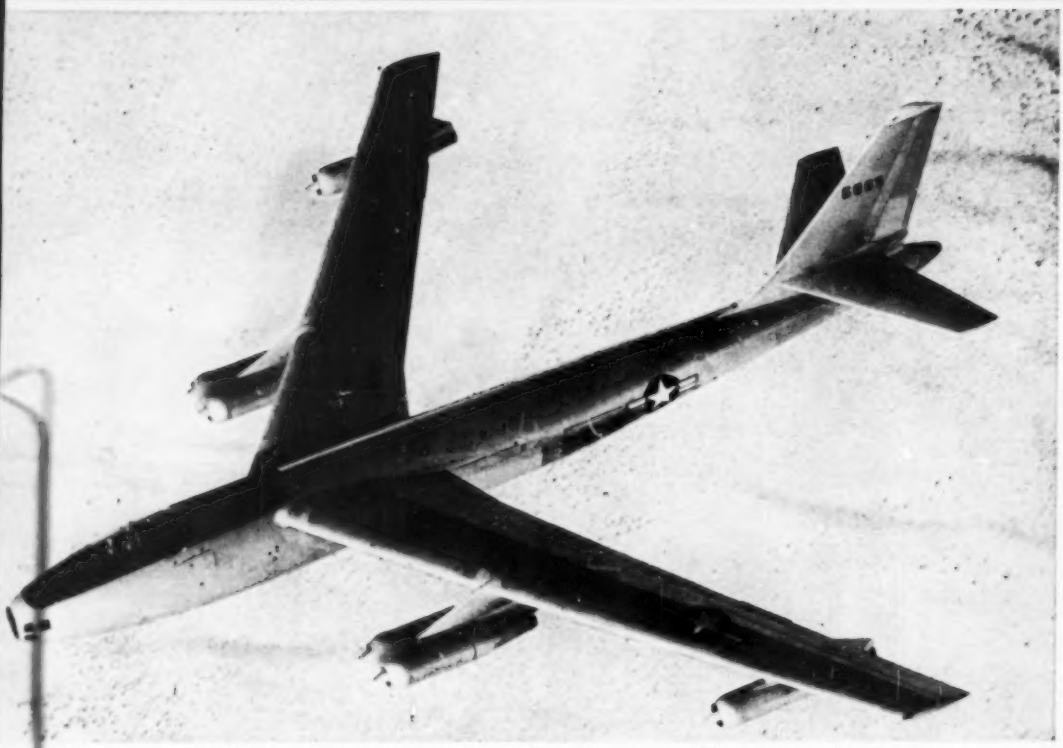
YOU'VE heard tell that when a test pilot flies at better than 600 miles an hour a lot of unhappy things happen to him. His head feels as if it were splitting, his vision gets blurred, he gasps for breath, and the controls in his hands are as stiff as iron.

It would maintain the glamor of test flying in this age of jets if all this were true. But it isn't. It's pure hokum.

It's my job to fly the world's fastest bomber—the Boeing B-47 Stratojet. Fully loaded, it weighs more than 60 tons. Yet it handles like an airplane a fraction of its size, and the sensations of flying it are those of a passenger seated comfortably in any one of today's fast air liners. The Stratojet pilot has no sense of extreme speed unless he flies near the ground or near another airplane—it's necessary to have a reference point to judge one's speed.

He feels, in fact, *fewer* sensations than an air-liner passenger. There is practically no vibration. That's due to the enormous reduction of moving parts, such as propellers, pistons, connecting rods, and associated mechanisms. A double wall, which contains the pressure cell and allows the pilot to be at the equivalent altitude of 8,000 feet while flying at 35,000, keeps a large amount of the sound out.

The control surfaces are powered to overcome the enormous air loads at high



Sleekest of USAF's bigger planes, bomber is easily recognized by huge swept-back wing and pylon-supported engines. Angled wing, giving effect of greater width, increases distance air must go to get over it, smoothing bumps and delaying compressibility at near-sonic speeds.

speeds. A pilot need exert only a small force to move them, the real work being done by boosters.

As for temperature, heaters keep you warm and refrigeration systems keep you cool. In short, you are comfortable, at ease, and less burdened with work than you would imagine. The main problem is navigation. Radio stations go by so fast that you are constantly tuning the radio compass to keep track of them.

The Stratojet, made for the U. S. Air Force by the Boeing Airplane Company, is essentially a "pilot's airplane." In checking out Air Force pilots, some of them top brass with many thousands of hours in everything from Jennies to jets, we company pilots have met with an almost universal reaction: "It's a bomber all right, but it handles just like a fighter."

A look at this airplane will show why. It resembles an arrow. Sleek, tandem cockpit seating for two pilots cuts air drag to a minimum. Each pilot has nearly 360-degree visibility, the only limitation being the other fellow's head.

Photo of B-47 landing shows bicycle landing gear, wing droop (indicating its flexibility),

Cockpit view over pilot's helmet shows that jet bomber's controls are somewhat simpler than in piston-engine planes—but still complex.

The landing gear is novel. The two main sets of wheels are located one behind the other, bicycle fashion. This arrangement allows the bulky gear to be contained in the fuselage rather than having to enlarge the compact, twin-jet engine nacelle to accommodate it. Two small outrigger wheels keep the airplane upright when at rest.

As you approach the airplane, you will note that the engines are strung out along the wing—a pair midway out and one near each wing tip. This gives better distribution of weight along the wing. Imagine six weights hanging on a long pole that is suspended at each end. If the weights were hung at the center, the pole would bend sharply. But if they were distributed along the pole, it would bend less or could be made thinner, the latter being just what the aeronautical engineer wants in order to knife his wing through the air. Distribution of engines along the wing also lessens their vulnerability to gunfire.

Still another benefit is a soft ride when the airplane encounters turbulence at high speeds. The wing, being thinner and therefore less rigid, does not convey the total shock to the airframe but absorbs it by deflection. This wing is designed to flex many feet, whereas comparable-sized aircraft may have a wing that flexes only a few inches. In other words, the wings bounce while the pilot stays still.

Sweep Back Gives More Speed on Less Power

There is a reason for those swept-back wings. When an air particle already moving near the speed of sound is diverted around the top and bottom of a wing, it must speed up even more. As it reaches the speed of sound, it begins to compress on the forward part of the wing rather than move around it. At this point the air takes on the characteristics of a solid. This creates what is known as a compressibility shock wave, which disturbs the flow on the wing and causes loss of lift and buffeting.

It has been known that this condition can be alleviated or postponed by decreasing the thickness of a wing in relation to its fore-and-aft width. Generally speaking, a wing one foot thick and six feet wide doesn't displace the air as violently as a wing one foot thick and five feet wide. If the same five-foot-wide wing is swept back 35 degrees, you will find that, in observing the path the air particle traces over the wing, the *effective width* of the wing has increased. This gives the air particle the break it needs, and an airplane so equipped can go faster under less power.

To get into the B-47, it's not necessary to scurry around for ground ladders. No gymnastics are required. You simply open the outer door and pull down an extensible ladder. As you climb aboard, it is easy to see that this cockpit layout was approved by a pilot before production. It is "right" and everyone who rides in the airplane is pleased with the arrangements.

Although the layman may not be fa-

and drag 'chute to slow plane, shorten roll.

miliar with the hundreds of gadgets in the conventional airplane, he is nonetheless appreciative of the responsibility of keeping track of them and the value in decreasing the number. Because of reduced control for jet engines, this has been accomplished in the B-47, and the two pilots can handle everything without a flight engineer.

For example, the engine start is a simple operation. You just select the fuel tank to be used, turn on your ignition, press a momentary starter switch to turn the engine to the proper r.p.m., and open the throttle to meter in the fuel. When the tailpipe temperature indicator starts moving, you know you've started. Taxiing out is also simple, for you can use just one master handle to control all six throttles, differential throttling being unnecessary because of the excellent nosewheel steering device used for directional control.

Warm-up procedures are eliminated, and just ask any pilot what this means on a hot summer day.

When all engines are at 100 percent r.p.m., you release the brakes and you're away. Just as the airplane becomes "tender" on the runway, you hit the JATO switch, giving 18,000 additional pounds of thrust. With the 24,000 from the engines, you have a total of 42,000 pounds of thrust, which is roughly equivalent to 42,000 horsepower for the duration of the takeoff rockets.

Gentle Hand Gives Big Push

Things are very interesting at this point. A gentle but powerful hand grips the airplane and starts you up in a very steep climb, overcoming the hazards of a short runway and obstacles at the end that still plague many airports. Being abruptly free of the earth, you allow the airplane to accelerate to more than 300 m.p.h. *before you even start to climb.* What this airplane will do in terms of top speed is still being withheld by the military, but the Air Force says it's in the "600-m.p.h. class." You will recall that on February 8 the airplane flew from its test base at Moses Lake, near Seattle, Wash., to Washington, D. C., in 3 hours 46 minutes for a point-to-point average speed of 607.8 m.p.h. for the 2,289 miles, all at altitudes between 35,000 and 40,000 feet.

Once at his predetermined altitude, the test pilot's job is plain hard work, involving controlled flying and gathering data during dive tests and performance runs.

As you start down, the rate of descent hits the peg at 10,000 feet per minute and you are soon on approach to the field. The gear comes down at 350 m.p.h. with a "chug"—the airplane feels that—and then the wing flaps come down for a slow landing. As you approach the runway you get ready to release the drag 'chute. This handy gimmick is a ribbon-type parachute attached to the airplane that enables the sleek, low-drag aircraft to stop on runways normally too short for it.

You taxi back with the drag 'chute riding off the ground. This is a valuable characteristic of the 'chute since it minimizes wear and allows the 'chute to be used repeatedly without repair.

Then you shut down and climb out.

You've just given a workout to a jet bomber that has many times outsped standard jet fighters—also in the 600-m.p.h. class—and at the same time is capable of carrying more than 20,000 pounds of bombs.

Racing the Clock

As a parting thought, you might recall the coast-to-coast flight of the Stratojet. If the airplane had flown from east to west, instead of from west to east, in 3 hours 46 minutes and you had been aboard and had changed your watch at each time line, you would have badly upset the standard airline schedule—breakfast in New York, dinner in Los Angeles.

You could have had breakfast in New York and 46 minutes later, according to your watch, had breakfast again—in Los Angeles. END

They're machinists. The alloy being machined builds up a false cutting edge on the top of the cutter bit, this can be prevented by grinding a somewhat greater angle at the upper surface of the cutter.

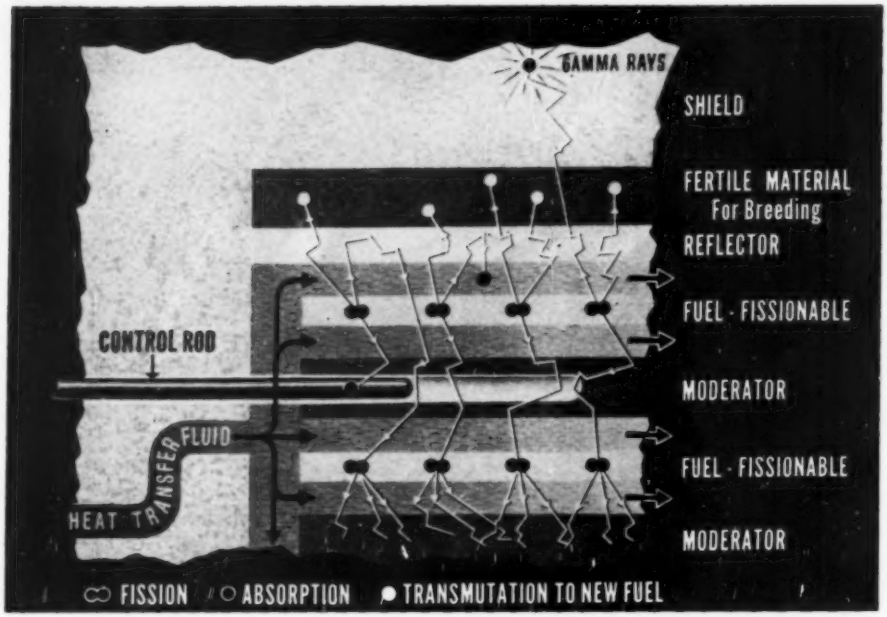
Paul Bunyan Gets Steel Fingers

HOISTING logs and heavy rolls of paper is easy for two new sets of steel fingers. In the forest (left), the toothed tongs above, controlled from the cab of a power shovel, lift logs with little damage to the bark. At the other end of the paper-making process (lower picture at left) curved fingers on the fork of a lift truck can hold two rolls of newsprint at a time. Hydraulic pressure provides the grabbing power in both sets of tongs. The log fingers are made by Berger Engineering Works, Seattle; the paper tongs by Marine Terminals Corp., San Francisco.

Water Tank Looks Like Golf Ball on a Tee

THE 50,000-gallon water tower at left gives a new look to the landscape near Houston, Texas. It's made of welded steel plates, cut and shaped so that the tank continues the outward sweep of the upper part of the supporting structure.

A ladder inside the tower, alongside the single filling and delivery pipe, goes on up through a vertical shaft within the spherical section. A trap door at the top of the ladder also gives access to the interior of the storage tank itself, and its rim provides an anchorage from which a bo'sun's chair can be hung when the structure needs painting or other attention on the outside.

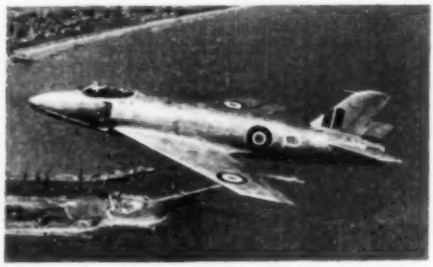


Boiler for an Atomic Engine

THIS schematic drawing shows what General Electric engineers expect to happen in their new nuclear reactor, planned both to produce power and breed more atomic fuel (PS, June '49, p. 124). Zigzag lines mark the paths of neutrons emitted when atoms of the fissionable material are split. The heat-transfer fluid will be a liquid metal and will come out at a temperature of several hundred degrees. It will be used to drive electric generators. Meanwhile, other neutrons will be colliding with atoms of fertile material and converting them into fissionable atoms. Under construction near West Milton, N. Y., the new engine is called the KAPL (Knolls Atomic Power Laboratory) reactor.

X-4 Spears Sonic Speeds

BUILT to explore flight at high speeds, this swept-wing bullet is powered by two gas-turbine engines. The Northrop X-4 is to continue U. S. Air Force research pioneered by the Bell rocket-powered X-1, first to outspeed sound. The small, 7,000-lb. flying wing, measuring only 25 feet from wing tip to wing tip, has tricycle landing gear and an ejection seat for the pilot.



Flies Faster than Sound

BRITAIN is not saying much about the Vickers Supermarine 510, shown above, except that it's faster than sound. It is a research plane, powered by a Rolls-Royce Nene jet engine with a 5,500-lb. thrust. Unlike the X-4, at left, the Supermarine is designed for eventual service as a fast fighter. Britain has announced another supersonic plane, the Hawker P. 1052.

New kind of educational toy is being made of standard-sized wood stock in upstate New York valley. Caricatures, they are pegged together for juvenile disassembly. Couplings are hooks and eyes.

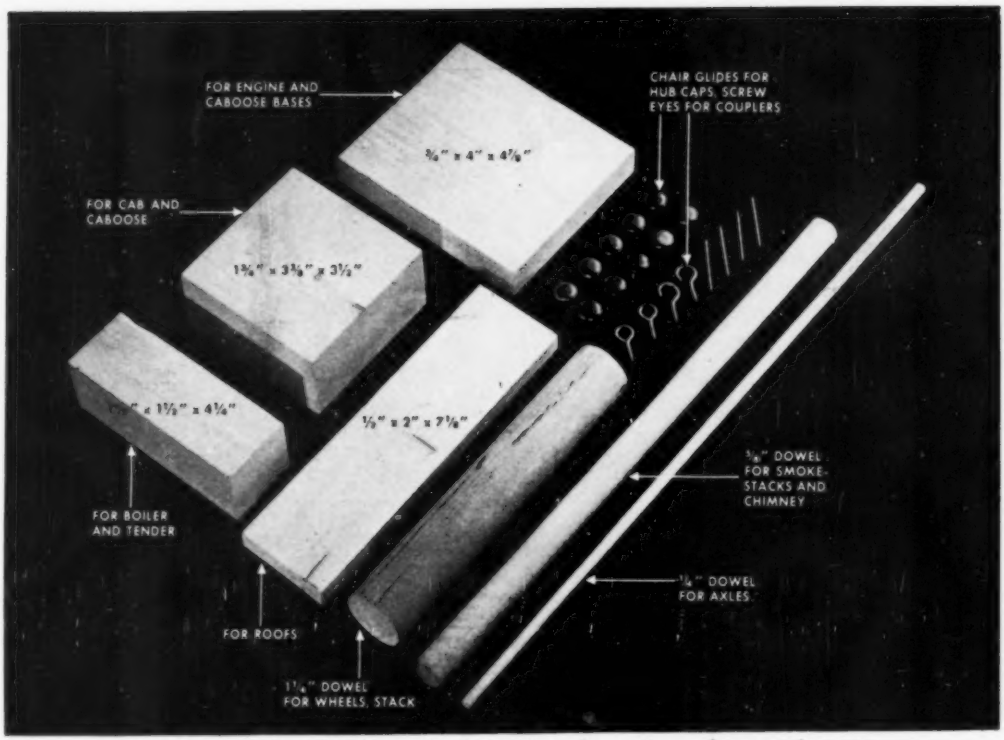
Santa's Factory Makes Toys the Easy Way

PS photos by W. W. Morris

IN UPPER New York State is a toy factory that would satisfy the most wistful dreams of childhood. Santa Claus lives just around the corner. Reindeer browse among white birch trees. A lollypop tree dispenses candy. There is a big iced white pole—the North Pole, of course.

This is the Children's Village, otherwise known as Santa's Workshop, North Pole, Whiteface Mountain, New York.

From the toy factory—the heart of the establishment, as it would have to be in any community at the North Pole—are coming thousands upon thousands of a new kind of toy. The toys are made of standard stocks of wood purchasable at any lumber yard. A man handy in a workshop could dup-



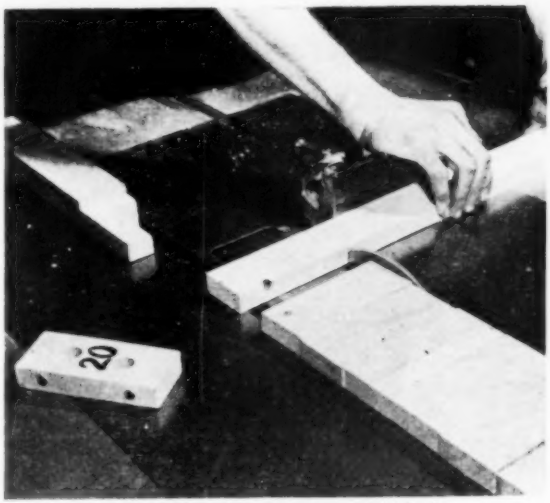
These are materials, mostly from lumber yard, that go into the train on the opposite page.

licate them in his own home with nothing more than a straight saw and a hand drill. These are the educational toys—all are done in caricature—that issue from the whirr of machinery at Santa's Workshop.

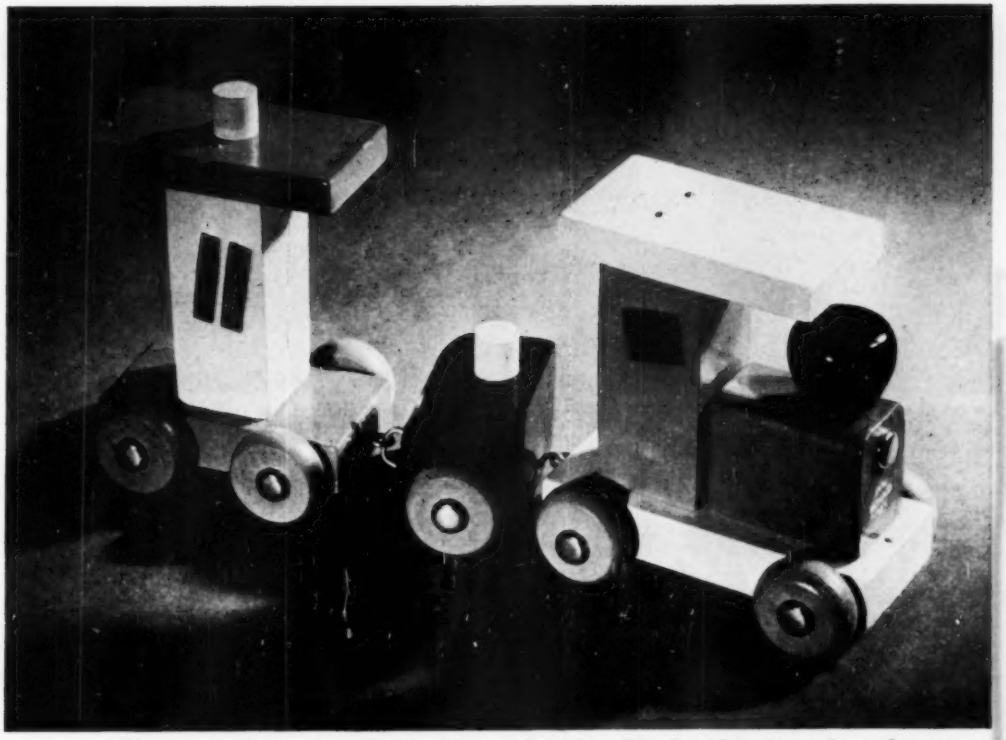
Another group of toys is comprised of circus animals, also made of wood, also caricatures. The camels, leopards, and clowns are a bit more complicated than the educational toys. Yet they are turned out with only hand saws, bits of felt, and paint.

Right now, the roof of Santa's Workshop is covered with snow, and everywhere you look there are alabaster mountain slopes, for this is in the heart of the Adirondacks. Almost a score of men and women are making toys under the direction of one of Santa's lieutenants. The lieutenant is a former Walt Disney artist who goes by the romantic name of Arto Monaco. For the record, he is an ex-GI. Also for the record he was down to his last buck when he began making toys.

Children's Village educational toys got that way because Monaco was looking for a



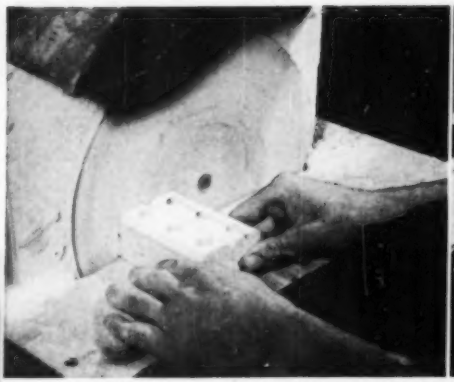
Cutting base for locomotive. It measures 4¾ by 2 by ¾ inches. Jig guides power table saw. Pre-Christmas work staff of Santa's Workshop is 18 men, women. Mailing address is Wilmington, N. Y.



This is a simpler version of train shown on first page. Wood used is pine, soft maple, or gum.

Wheels can be cut from dowel on bandsaw, but factory can get them cheaper from toy factory specializing in wheels. They are 1½ in. in diameter. Rims are sanded to make "tires."

Holes for pegs are sunk with multiple drill. Depth, diameter are the same—⅜ in. Standard pegs are 1½ in. long; smokestack's, 2 in. Designer Monaco's father helped establish shop.

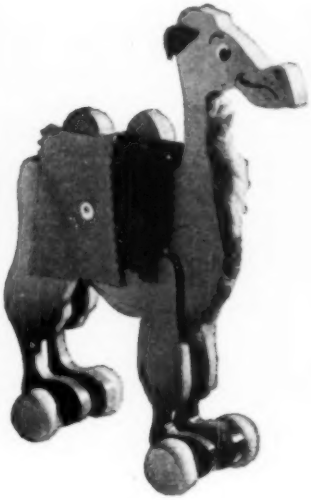


Locomotive boilers are smoothed down on disk sander. After this they are buffed to take off any sharp edges and then put under blower to remove wood dust from holes before painting.

In lacquering shop, boilers are put on screen rack and sprayed under 15-lb. pressure. Higher pressure would blow blocks off rack. Next step is stacking for a 6-hour drying period.

means of turning out toys with unskilled help. People up there in the mountains know a lot more about skiing and tobogganing—nearby Lake Placid is famous for its winter sports—than they do about making things in a factory. So Monaco reduced his caricatures to their barest essentials and planned his factory from scratch. Saws, hammers, drills, sanders, paint guns and paint brushes, and tumblers for sanding, painting, and waxing are his only tools.

The educational toys are pegged together with just enough play between peg and hole



Creator of new toys designs a donkey as an item for his circus line. Manufacturing materials will be 3-ply gumwood and felt. Typical other circus toys are the leopard, shown at the left above, and the camel at the right.

Wheels are attached by tapping ¾-in. dowel into hole slightly smaller. Dowel, 2¾ in. long, runs through base of toy to form axle. It turns easily in a hole ⅜ in. in diameter.

For fancier models, artist lacquers locomotive, paints in windows. Caboose gets wood awnings and painted polka-dot curtains and window box with flowers. Paints, lacquers are non-toxic.

to make them go together and come apart easily. Pegs are of a standard size so that if a preschool-age child whimsically wants to put a locomotive boiler on a caboose, that's his privilege. No nails are used.

At the start of his manufacturing, Monaco nailed his wheels onto the bases of his toys. The head of his sales department trotted down to New York City to sell some of the toys to one of the big department stores.

"Hmm," observed the matronly buyer for the store, yanking away at one of the wheels, "see!" It came off in her hand. "I won't buy anything," she stated almost accusingly, "that's not substantial."

The salesman reported to Monaco. "I'll fix *her*," said Monaco.

Imp-Proofing Ends Sales Resistance

Now his axles are dowels that run all the way through the base of the toys. They fit loosely, to turn. The wheels are hammered on to the ends of the dowel and fit too snugly to be pulled off by the most destructive imp in the neighborhood. (On the next trip, the department-store buyer bought.)

The toy factory and the children's village came about because a 6-year-old girl asked her father, one winter day, where Santa Claus lived. Her name was Patricia, and her father, Julian Reiss, New York and Lake Placid business man, got to mulling over the idea of establishing a home for Santa. The more he thought about it, the better he liked it.

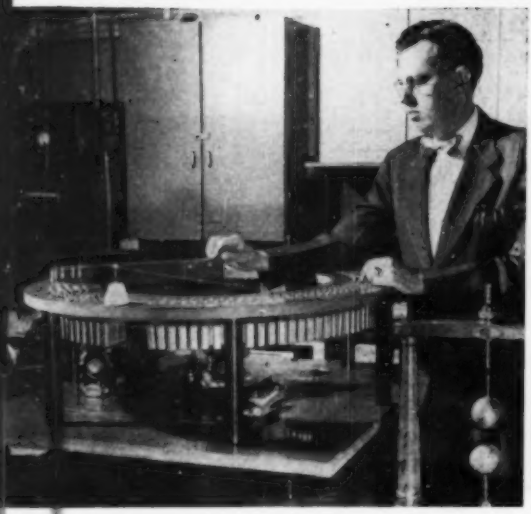
He called in Harold Fortune, known for his original ideas in building showplaces, and together they called on Monaco, who had settled in nearby Upper Jay, N. Y., to make toys. Monaco wasn't doing so well. Graduate of an art institute, he had worked in Hollywood and New York before being drafted into the Army in the spring of 1941.

While he was in service he was stationed for a time at Aberdeen Proving Ground, in Maryland, where he made models for the Ordnance Department. That's where the toy idea developed. He was bored stiff on week ends, and to while the time away he made wooden toys for a nephew and some of the youngster's playmates.

On the day that Reiss called on Monaco he hadn't said half a dozen words before the artist was planning the Children's Village. He designed the workshop, complete with nine pine log houses, all with colored roofs and crazy-tilt chimneys and enough of the gingerbread touch to draw 25,000 tourists a month.

There is a reindeer barn, Mother Hubbard's Cupboard, a post office where the small fry can write out their outrageous Christmas-toy demands, burros, sheep, goats, ponies, and such storybook characters as Little Bo Peep, Huckleberry Finn, and Peter Pan. There is an exhibition toy factory run by gnomes so Monaco can maintain his amateur standing. And there's Santa, of course, on duty twelve months a year.

There's a trout stream in the toy factory's back yard. It's real. One of Monaco's—pardon, Santa's—workmen pulled a 21-inch, 3¾-pound trout out of it last summer during his lunch hour. END



Wheel Multiplies Voltage

THE voltage of an ordinary generator, seen at lower left, is multiplied 100 times by this merry-go-round device developed for research by General Electric. It works somewhat like a water wheel that develops power as its buckets fill with water. A hundred capacitors accumulate energy by picking up charges through brushes on a sweeping arm. When the 1,000 volts of the generator have been raised to 100,000 volts, a tiny streak of "lightning" shoots between the two spheres at lower right.

How to Freeze in Comfort

THIS sailor, sitting in a tub of ice water, is trying out a new flying suit designed to protect pilots who may have to bail out into arctic waters. He is Navy Corpsman Melvin Maki, and the survival suit he's wearing is made of poplin and nylon. It weighs five pounds and is impregnated with a plastic that permits the passage of body perspiration. Maki claims that he was comfortable after a long ice-immersion at 34° F. In actual use the suit would ward off death from freezing for several hours.

Land Wheels for Sea Wings

FLOATPLANES are often built at landlocked factories. This presents a take-off problem in the delivery flight. De Havilland of Canada has found the solution in a wheeled cart on which the seaplane rides pickaback until it gains enough momentum to take off, as shown at lower left.

With the cart, the plane floats rest on two V-shaped troughs, designed for a snug fit and lined with sponge rubber to protect paint finish. These troughs ride on a pair of rubber-tired wheels. Behind the troughs is a wooden cross member that gives extra support to the float keels and is fitted with a swivel tailwheel. When the aircraft and its undercart reach a speed of about 60 m.p.h., the pilot takes off, and the dolly, weighted down by about 100 pounds of ballast, runs along the ground a few hundred yards.

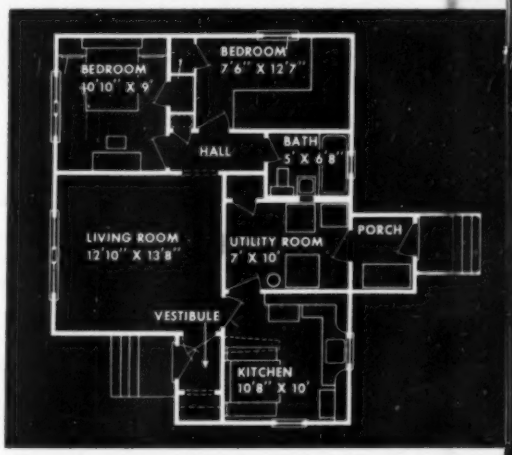
Previously, the floats had to be removed after factory inspection, and replaced by a wheeled undercarriage. Then the craft was flown as a landplane to its delivery points, where a switch back to floats was made.

Rough outside, but modern inside, prefab log cabin is home of RCAF commander in Yukon.

Far North Cabins Are Now Prefabs

A COMBINATION of the old and the new is helping to solve the desperate housing shortage in the far North. From the outside, it looks like a traditional log cabin. Actually it is a completely prefabricated home, designed on a four-foot module. Manufactured in sections at Winnipeg, Man., they are shipped to places like Watson Lake, Aklavik, and Coppermine.

Inside, these homes are entirely modern, with up-to-date bathrooms, kitchens with work counters and cabinets, and forced hot-air heat. Except in the living room, all furniture—even the beds—is built in. Made by North American Buildings, Ltd., the houses sell for $8,000 to $10,000. END

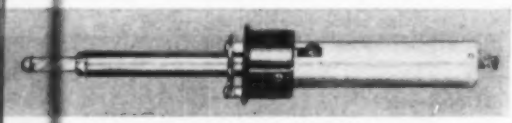


Floor plan above shows convenient layout of factory-built cabins. They are made in several sizes, with two to four bedrooms.

Kitchen has up-to-date work counter and cabinets. Automatic clothes washer and drier, as well as built-in furniture, come in package.

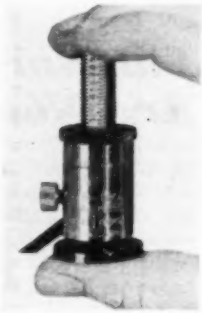
Workmen at home site need do little more than assemble the sections and add 1½-inch log siding, which also comes in panels.

Portable Bandsaw. Weighing only 30 lb., this combination bandsaw and shaper is a cinch to carry to the job. Double pulleys give blade speeds of 700 or 2,400 feet per minute. Unsnapping the two-part table top gives you access to the belt. The shaper attachment, at the right-hand corner, uses rotary files to cut sharp contours. Guard, top, and case are heavy-gauge steel, welded and reinforced. A sheet-metal partition in the case keeps chips out of the motor. Maker is H. & S. Machine Co., Methuen, Mass.



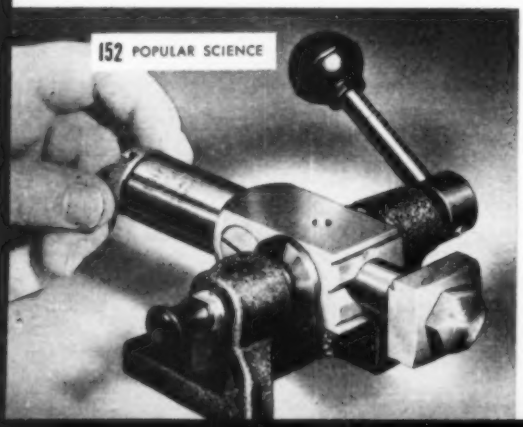
Iron Holds Proper Heat. Big feature of this 6-oz., quick-heating soldering iron is that it can't overheat. When the fast-heating portion of the coil has brought the tip to the right temperature, a bucking coil cuts down the current and holds the heat at that point until the juice is cut off. Instant Tool Corp., Binghamton, N. Y., is the maker.

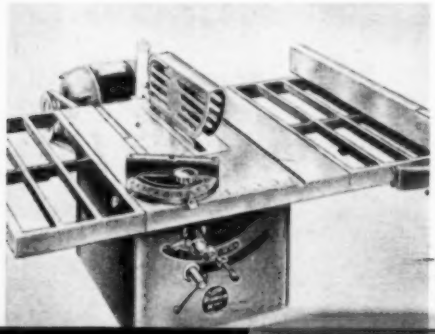
Height Gauge. Mikro Marker®, made by Metal Items, Racine, Wis., is a height gauge that reads like a micrometer. Readings run from zero to 1", graduated by thousandths. Priced at $12, it's compact, easy to handle, and is convenient for working in restricted areas.



Vise Holds Small Parts. Made by Metal Items, Racine, Wis., the Mikro-Vise® consists of a vise and a fixture. The 1¾" wide jaws open to 1¾". Two Vs hold round stock, and insert pins are included to grip odd-shaped parts. The fixture can be set at various angles for milling, drilling, grinding, and shaping small parts.

Circular Saw Has Tilt Arbor. The ball-bearing arbor, not the table, of the Power King 3001® tilts to 45°. Adding two low-cost extensions enlarges the 12" by 16" table to 16" by 25½", with 7⅞" working space ahead of the blade. The price, $39.50 less motor, includes blade, fence, miter gauge, guard, splitter, motor pulley, V belt, and motor rail. Atlas Press Co., Kalamazoo, Mich., makes the saw. Maximum depth of cut is 2¼". The fence has clamp locks at each end and can be quickly removed.





Polystyrene comes to manufacturing firm in big "logs" that have a rough, barklike exterior.

Christmas "Snow" Made of Plastic

YOU'LL be able to trim your Christmas tree this year with "snow" that looks and feels like the real thing and even goes it one better—it doesn't melt. Made of snow-white polystyrene plastic, it is about 97 percent air and actually has a texture like snow. A cubic foot of it weighs only two pounds. Buoyant, it was used during the war as a flotation material in life rafts. Schwab & Frank, Detroit, which developed special machines for forming the "snow," uses it to make snowballs, stars, bells, and other tree ornaments.

Shaping machine trims off rough surface and creates flat slabs from plastic sections. These are cut into smaller pieces with power saws. Ornaments are made with series of special tools.

Plastic is easy to carve. It is turned into shapes like snow man below. On a Christmas tree ornaments glisten like snow—but don't melt. Balls at right can't hurt if they hit you.

Specially designed for rough-and-ready flying, the Beaver still gives a comfortable ride, reports PS Managing Editor Volta Torrey after his tour of the bush country in one of the new planes.

This is what the bush looks like. The innumerable small lakes and streams give you a landing spot wherever you want it—on water in summer, ice in winter. One of the few good roads, the Alcan Highway, can be seen in the center of the picture above. Railroads are even scarcer.

The Beaver, new half-ton truck with wings, can land on or take off from anything bigger than a puddle.

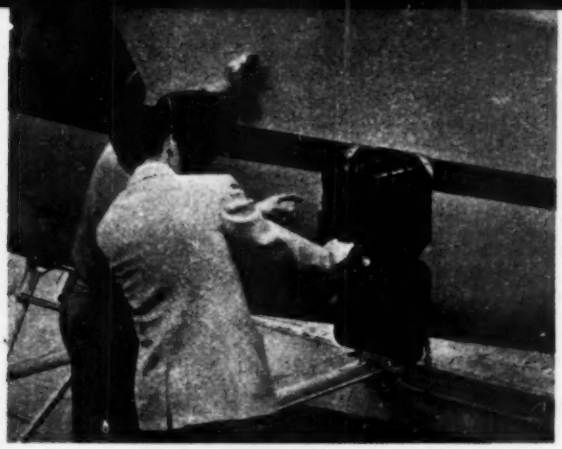
PS PhotoStory by Volta Torrey

WHERE the dirt roads end and the rivers flow north, the bush flier must be cabbie, mailman, freighter, ambulance driver, and Santa Claus. His customers are trappers, prospectors, fishermen, traders, Indians, and Eskimos. He hauls everything, from oil drums to pregnant women. His everyday runs cover long distances over lonely, rugged terrain.

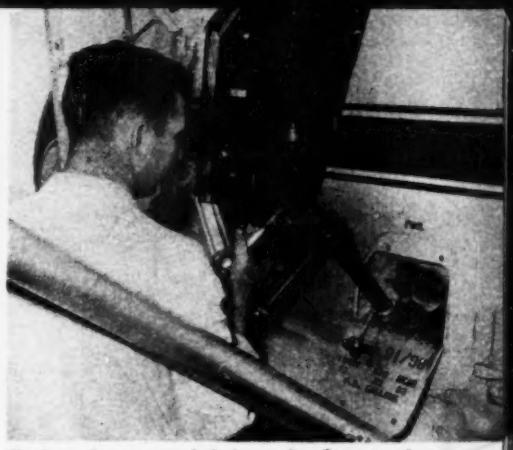
This frontier business was built up with all kinds of planes, none specially designed for the job. But now de Havilland engineers have developed what amounts to a half-ton truck with wings. It is the Beaver, a high-wing, all-metal, seven-passenger plane with a Pratt & Whitney Wasp Junior engine.

The Beaver isn't pretty. But it can take off on floats within 795 feet in 15¾ seconds—under the worst conditions. On wheels, a Beaver has left the ground in four times its own length. It can climb 1,290 feet per minute at sea level with wheels, and 1,200 with floats. It cruises at 110 m.p.h. or better.

Bush pilots appreciate other features, too, such as its widely spaced floats, and two doors on each side for easier loading.

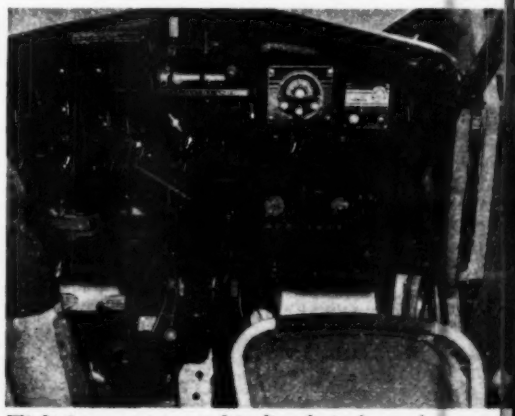


To get at the batteries, you simply pull out a tray in the side of the plane. It can be reached from the shore or the float. Self-connecting contacts make it easy to service the batteries quickly —an important consideration to bush pilots, who must fly in very cold weather.



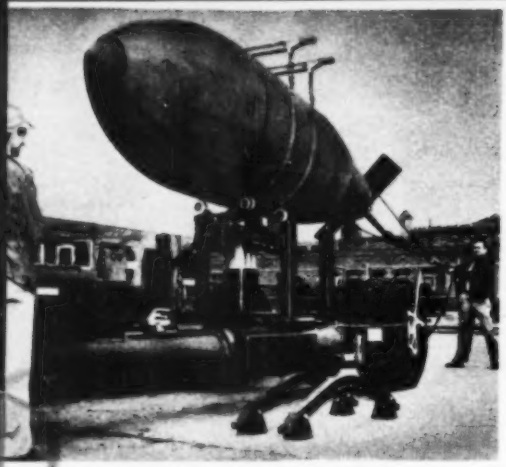
Fuel tanks, suspended from the floor in the fuselage belly, are filled from these ports on the side of the plane. This arrangement means you can gas up while standing on the float or shore, without climbing up on the wing. Capacity of all three tanks is 87 gallons.

The rear door—there's one on each side—is 39 inches wide. Three 45-gallon gasoline drums, weighing 380 lb. each, can be carried easily.



Flight-instrument panel is directly in front of pilot's seat (left), engine instruments are in center. The rear cabin seats six passengers.

As a seaplane, the Beaver rides up on the "step" (the notch in the bottom of its pair of floats) as soon as the throttle is wide open. It takes off quickly, can clear a 50-ft. obstacle in 1,195 ft., under adverse conditions. Picture was made on typical Alaskan stream near Fairbanks.



Bomb Lift Heaves Heavies

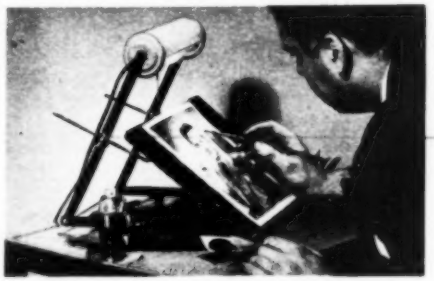
THIS new, mobile lift can push a 50,000-pound bomb around like a toy. Recently demonstrated at Wichita, Kans., it raised the giant bomb above 12½ feet from the ground into the bomb bay of an Air Force bomber. Hydraulically operated, it is mounted on a wheeled carriage so it can be used to haul bombs from storage to waiting planes. In addition to lifting the bomb, it can roll it around in a full circle, shift it eight inches sideways, move it 10 inches forward or backward, and tilt it six degrees up or down.

Mighty Midget Smashes Rock

A BIG hill in downtown Los Angeles and a concrete tunnel under it are being broken up and carted away without a single blast of dynamite. The secret of this quiet demolition job is shown above: a small, hand-operated hydraulic cylinder that pushes out a row of tiny pistons along one side. You put it in a hole, pump the handle a few times, and a pressure of 15,000 lbs. per sq. in. cracks off eight-ton chunks of rock or concrete in a single operation. Called the Duncan Roc-Jack®, it is only 24 inches long.

Tilting Easel Sports Light

THIS combination light and adjustable-tilt easel (right) is the latest thing for photographers, artists, stamp collectors, jewelers, and other persons who must do close work. The light can be rotated to any position to insure even lighting at any angle of the easel. Called the Easelite®, it can also be used as a sickroom or bedroom reading light and book support. Made by W. D. Rhodes & Co., of Chicago, it sells for $5.95.



Ski Ladder Aids Ice Rescues

THIS new Ski-Ladder® lets rescuers reach ice-accident victims without falling in themselves. Consisting of a 22-foot fire ladder fastened to outsize skis, it permits rescuers to straddle a hole in the ice and spreads their weight over a large area to prevent further breaking. A duck board provides a walkway. Invented by District Fire Chief Farquhar Langton, of Springfield, Mass., the device is made by A. G. Spalding & Bros.

Sound Waves Boil Water

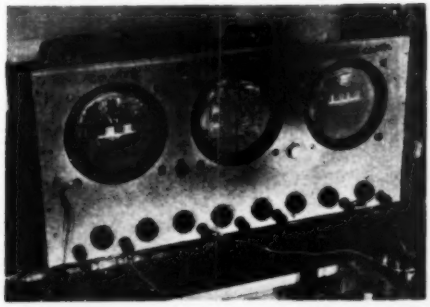
A WAFER-THIN quartz crystal in the plastic case atop the cabinet above has been used by GE to cook eggs, shatter glass, mix paint, boil water, churn butter, and homogenize milk—all by setting up sound waves beyond the range of human hearing. Vibrated when an electric voltage is applied across it, the crystal generates frequencies up to 1,000,000 a second, used to study ultrasonic applications. Test objects are placed in a metal cylinder above the crystal. The tall glass tube catches spray of vibrated liquids.

Code Trainer Uses Dry Cell

FOR radio hobbyists who want to learn dot-dash communication, a new type of practice set has been developed that uses no vacuum tubes. A single 1½-volt flashlight battery powers the set. Called the Duplex Practicode®, it has a 4-inch speaker, is non-radiating, and is completely portable. For long-distance duplex operation, external terminals are supplied. As many as six sets can be operated on one line. The set has a tone and volume comparable to those of professional sets. Martin Mfg. Co. makes it.

"Brain" Has Elephant Memory

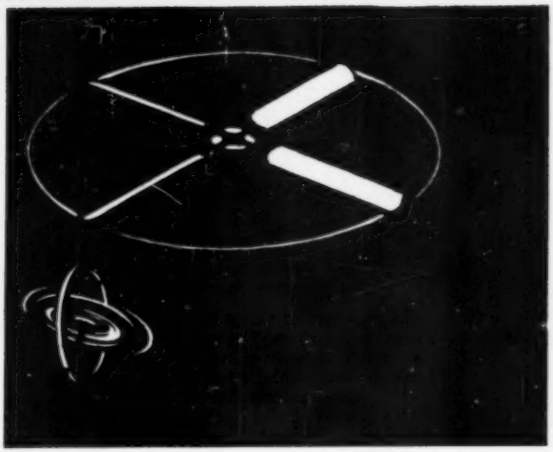
"EDSAC"—short for Electronic Delay Storage Automatic Calculator—is the name of Britain's new automatic brain. It is the first of the giant mathematical machines (see PS, May '49, p. 148) to "remember" by placing electric charges on a cathode-ray tube (center screen below). This system gives Edsac an unusually fast, high-capacity memory for holding numbers and instructions needed in solving complex problems.



Pants Hanger Fits in Cuffs

A NEW kind of pants hanger that clamps from the inside out instead of from the outside in has been put on the market by a firm in Beverly Hills, Calif. Made of plated spring steel, it is known as the Hold-Tite Pants Hanger®. Instead of holding the garment by pressure and friction, the hanger is compressed to fit inside the cuffs. Released, the spring action holds the cuffs taut. The maker, Brubaker-Ungrin, also sells a skirt hanger.

'Copter Top Tilts to Cure Shakes



A 28-year-old engineer studying stresses comes up with a brand-new machine that's easier to handle, safer to fly.

By Devon Francis

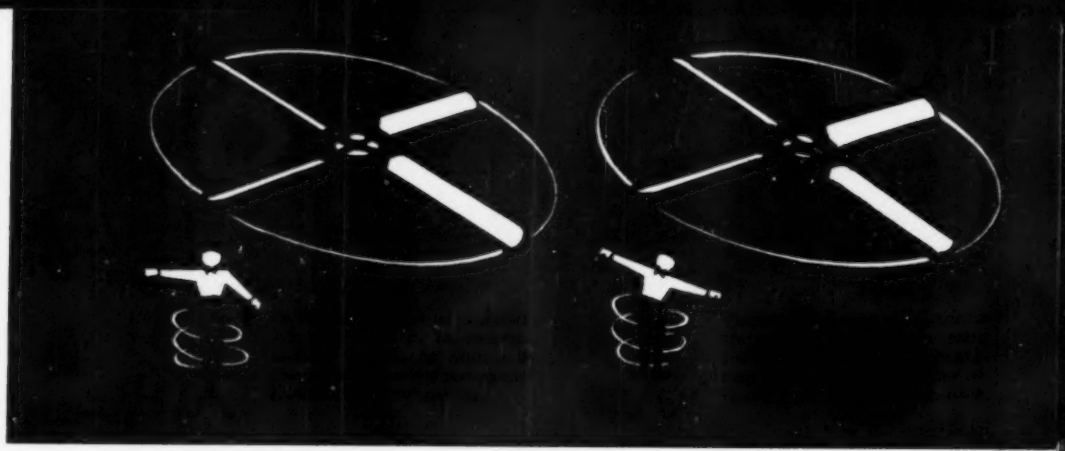
PS photos by Hubert Luckett

AN ENGINEER with a king-size curiosity has taken a lot of the jitters out of a helicopter. His curiosity was about the almost incredible stresses developed by the flailing blades. It has led him to come up with a rotor head—the thing the blades attach to—that tilts freely to every point of the compass.

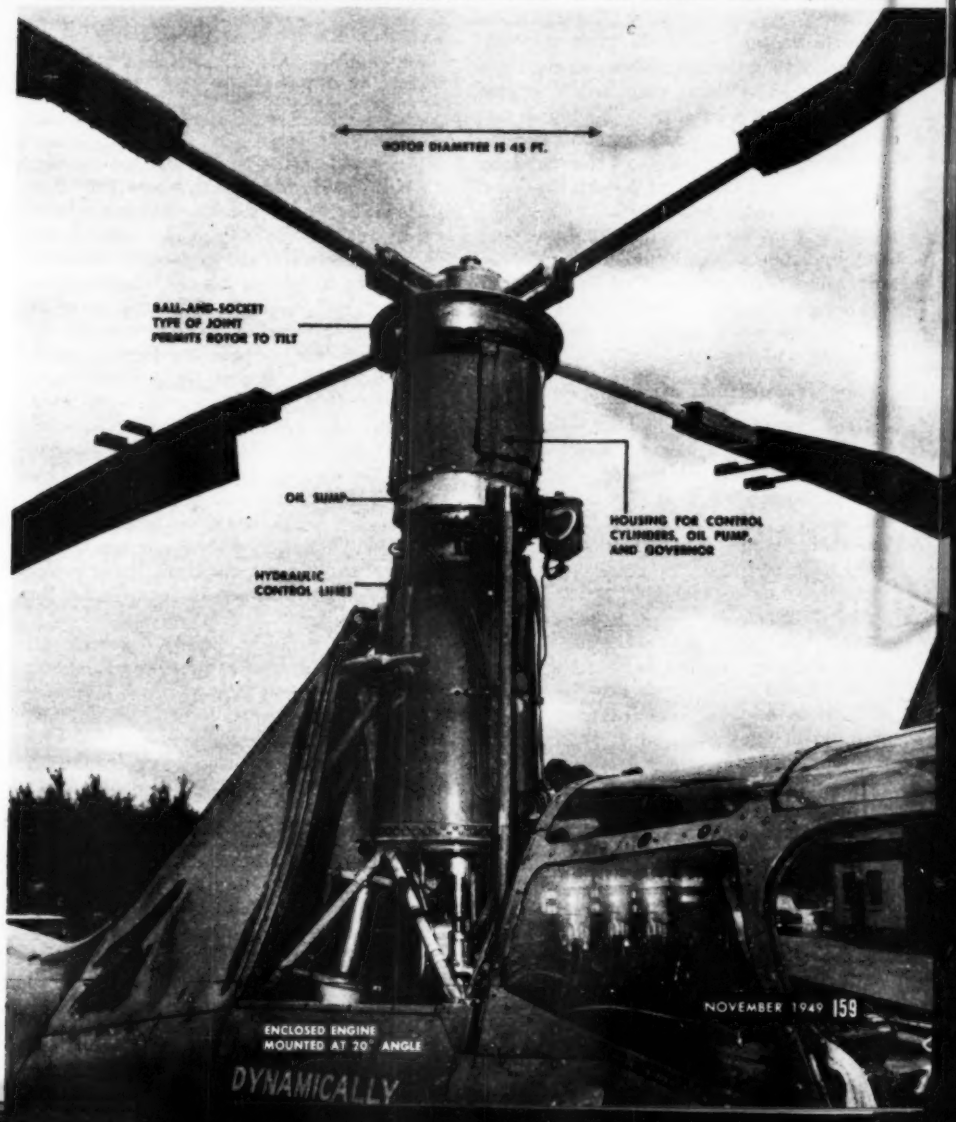
As a result, Glidden Doman's helicopter, now undergoing tests at Danbury, Conn., for a CAA Approved Type Certificate, is the first flying machine of its kind that doesn't have to be loaded as you would balance an apothecary's scale. Many helicopters have to tote lead weights around. These are shifted to keep the center of gravity directly under the center of the blade when cargo or passengers are taken on or discharged. Doman's doesn't.

Doman also claims that his ship can be put into violent maneuvers without danger, that it responds to control movements instantaneously, that it has what airmen call "inherent stability" in all attitudes. And the control stick doesn't vibrate. Both PS photographer Hubert Luckett and I flew in Doman's creation, and we can testify to that.

The tilting rotor head is a product of a number of cockeyed facts about helicopters. *All* helicopters have to be controlled by tilting the rotor *disk*. That's the pattern described by the blades as they whirl around. If the blades were attached rigidly to a fixed upright support, the sheer gyroscopic forces developed would throw the machine out of control. The rotor is a natural gyroscope.



Balanced Doman rotor (below) allows 3,200-lb. machine to tote unusual load of 1,400 lb.



A gyroscope wants to keep revolving in the same plane. To try to force control on such a gyroscope would invite fracturing the blades.

Up to the time of the Doman experiments, there were only two ways of attaching blades to the rotor head. If the rotor had more than two blades, they were hinged so that they could flap up and down. If it had only two blades, they were put on a teeter-totter, and the same flapping motion resulted.

That equalized the lift on both sides of the machine. As a blade swept into the wind stream in forward flight it flapped up to lose lift; as it retreated from the wind it flapped down to gain lift. In addition, it was necessary to provide cyclic pitch control (PS, Oct. '47, p. 148) so a pilot could maneuver.

That brought problems. A blade makes a complete flapping cycle for every rotation. And every time it flaps it yanks at the rotor head like a bulldog on a stick. That's because it describes a *smaller circle* when it's up and a *bigger circle* when it's down. You can demonstrate the stresses on the rotor head by holding a heavy dumbbell in each hand and whirling around on a piano stool. If you start with the dumbbells straight out from your body and then suddenly pull them in close, your speed will increase. That characteristic of helicopters makes a drag hinge necessary. This lets the blade move back and forth as well as up and down.

Taxiing Still Caused Trouble

Now everything should have been fixed. But it wasn't. Engineers discovered that when a helicopter is taxiing over rough ground the landing gear sets up vibrations that crawl up through the rotor head to those fore-aft blade hinges. The blades proceed to whip back and forth violently unless other corrective steps are taken.

So hydraulic dampers had to be introduced to limit their travel. They work, but they also re-introduce the stresses on the rotor head in flight. Rubber mountings to ease the shock of all these movements were also tried in place of drag hinges, but these upset the stable relationship of the engine, rotor head, and blades to the fuselage of the helicopter.

Doman decided to do away with the flapping movements of the blades on a horizontal hinge by attaching them solidly *and letting the whole rotor head tilt*. This automatically did away with the stresses imposed on the hub. It also did away with most of the vibration associated with helicopter flight because blade flapping is its main source.

Inventor shows additional control for balancing 'copter fore and aft. Lever works vestigial tailplane. Behind right-hand stick is pitch-control lever and throttle. Craft's ceiling is 14,000 ft.

That wasn't all. Doman knew that if a blade hit a gust of wind, his tilting rotor head would put the machine in the scrap heap. That was because of the gyroscopic character of the rotor disk. If you lift one side of a gyroscope, it will respond when the point at which you apply the lift has revolved 90 degrees. Therefore, a blade struck by a gust as it came into the line of flight would have tilted up when the blade was in front of the machine. This automatically would have increased the angle-of-attack of the following blade, like an airplane wing in a climb. That would throw the machine out of control.

So he had to add one thing more—an automatic blade-feathering device inside the rotor head to keep the angle the blade makes with the air stream constant, regardless of the tilt of the disk.

The combination of the two developments lets Doman shift his load past the helicopter's center of gravity either way. Because vertical drag hinges aren't kicking the blades around, the control stick is smooth. The "feel" of his stick is the same as that in an airplane under varying conditions of gravity pull in maneuvers. That wasn't a principal object. It was just an extra dividend.

Doman is a stress-analysis expert. Before establishing his laboratory at Danbury, Conn., he spent two wartime years with an established helicopter company learning the established fundamentals. Now he has added some fundamentals of his own. END

Riders Make Mechanical Animals Walk

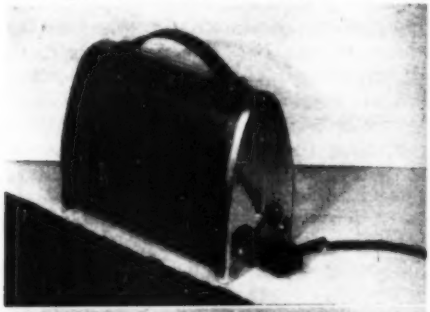
If you throw your weight around, you can make this toy elephant (above, right) walk. Each leg is connected to the body by an off-center pivot arrangement. When your weight is shifted from the legs on one side of the animal, the pivot swings them forward. Lean from side to side, and the elephant shuffles along.

Welded steel feet, curved like chair rockers (above, left), slide easily over level ground. A lever that protrudes from the elephant's neck turns the front legs in the direction you want to go.

Inventor A. M. Bennett, of North Hollywood, Calif., says the gadget is more than a toy. Doctors think it may be used as a physiotherapeutic device for convalescents. Small models will retail for about $35.

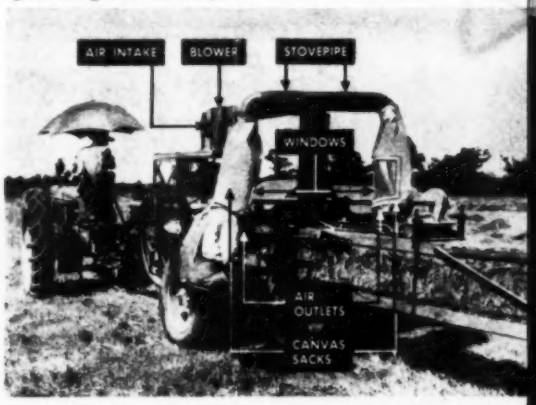
Hot Box Heats Lunch

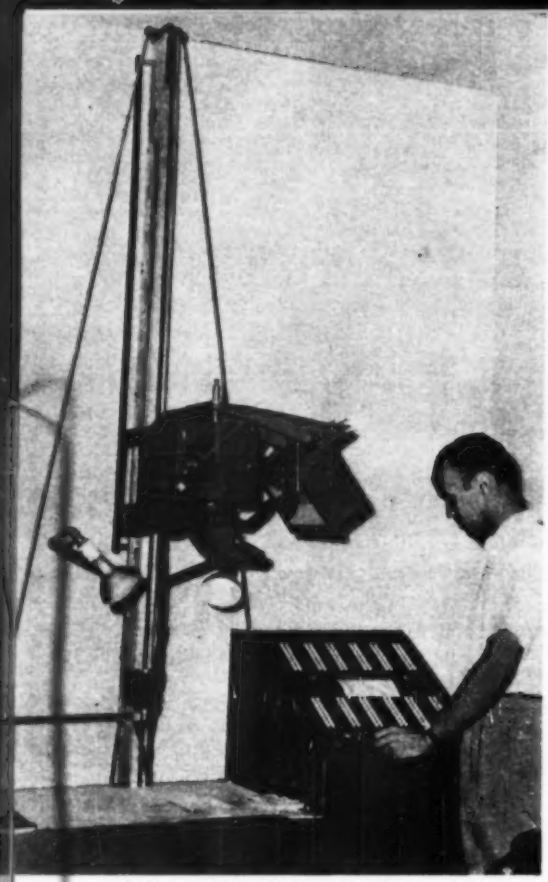
Tired of eating a cold meal every noon, Alva H. Privett, of Oakland, Calif., built a hot plate into his lunch box. A compartment in the bottom of the box contains a heating element that can be plugged into any 110-115-volt, AC or DC socket. Other compartments hold a vacuum bottle and sandwiches. Privett calls his lunch box the Thermette®. He hopes to market it for $7.95.



Hay Baler Air-Conditioned

If you have to make hay while the hot sun shines, why not bale it in air-conditioned comfort? This setup, devised by Herbert Hahn, Jefferson City, Mo., lets you do just that. A V belt operating off the baler mechanism runs a blower that pipes fresh air into sacks fitting over the heads of the men who run the baler. Plastic windows in the sacks provide good visibility.





Modified Recordak® microfilm camera records data on movie film. Auxiliary lens and mirrors simultaneously project code pattern into camera from the panel of lights at the right.

Operator punches out code pattern on this keyboard for data being photographed. Keys light up corresponding squares in bank of lights above as shown in the next picture, at right.

Machine Finds Facts for You

Electronic researcher scans 60,000 bits of information per minute and takes pictures of those that interest you.

By John F. Loosbrock

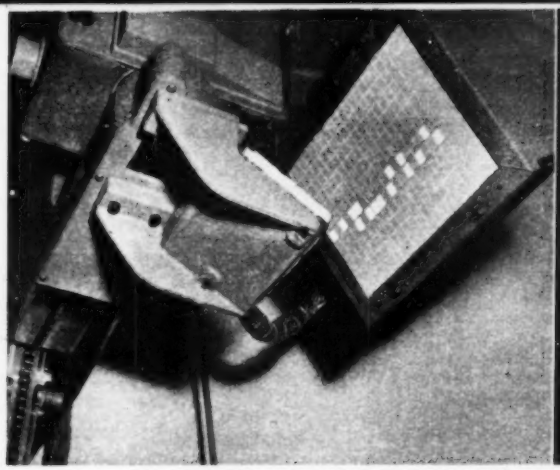
SUPPOSE you're a scientist beginning a research program on penicillin. You'd like to check everything written on the subject so you won't duplicate work that has been done. Just put a card with a lot of little holes in it into a machine, press a button, light your pipe, and relax. The machine will pore over 60,000 bits of information a minute, pick out what you're after, and make a picture of it that you can take back to your lab. You don't even have to take notes.

Pipe dream? Not any more. A device called the Rapid Selector, developed for the U. S. Department of Agriculture, makes child's play of the grim search through dozens of card files that is the researcher's nightmare. No more looking for a needle in a haystack. A camera, punch cards, reels of film, and a highly ingenious machine are taking the drudgery out of research.

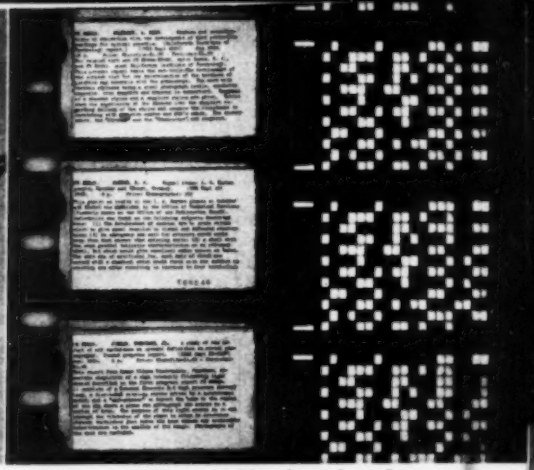
To do this, the Selector uses photoelectric cells, like an electric-eye door. You know how your body breaks a beam of light and a relay opens the door. Now, imagine a door that's choosy. It opens only for a man who is five feet tall, weighs 187 pounds, speaks Spanish, lives in Hoboken, and is left-handed.

That's a rough idea of how the Selector works. It picks out the specific information you want from a mass of data photographed on 35-mm. movie film. Each 2,000-foot reel holds the equivalent of 500,000 3 x 5 cards. And beside *each frame* is photographed an identifying code of black and white squares.

To get your dope, you punch out in a black card a series of holes corresponding to the combination of squares that mean penicillin —or whatever your subject is—in code lan-



Each two rows of lights represents a different code that may be assigned to same piece of data. Mirror reflects light pattern into the camera alongside the image of the data card.



This sample piece of film shows how data are recorded and classified on microfilm. Patterns of white squares at the right of each image of typed card are codes to trigger copying camera.

guage. Slip that master card into a slot, press a button, and the machine takes over.

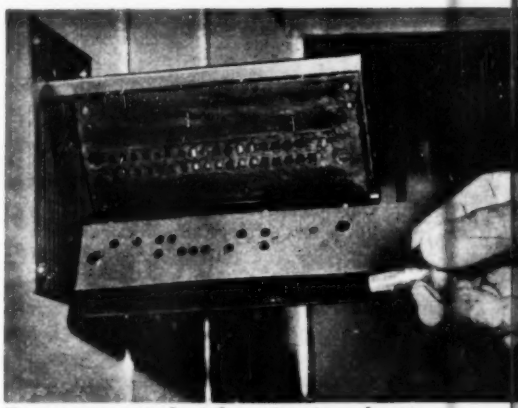
As the film unwinds, photoelectric eyes check 1,000 pictures a second. When the code pattern in a frame coincides with the master card, a very high-speed flash lamp activates a copying camera and makes a print of that frame. In a few minutes you have a picture of everything on that reel that pertains to penicillin.

The Selector breaks a tight research bottleneck. Man has been collecting information for thousands of years. With microfilm he can store vast amounts of it in a small space. The problem has been how to lay hands on the specific fact you want. Like rummaging through your attic for that old fishing hat, you know it's there. You just can't put your hand on it.

Elaborate cross-filing systems help. But reference cards take up storage space and winnowing through them also takes time.

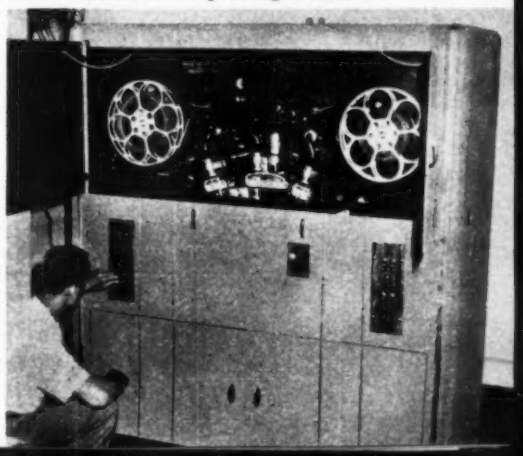
In contrast, it takes the Rapid Selector only about 15 minutes to run through 30 years of *Chemical Abstracts*, a standard digest of articles on chemistry, when they have been microfilmed and coded. The Selector has a potential capacity of ten million different subjects. And it doesn't care in what order they are stored.

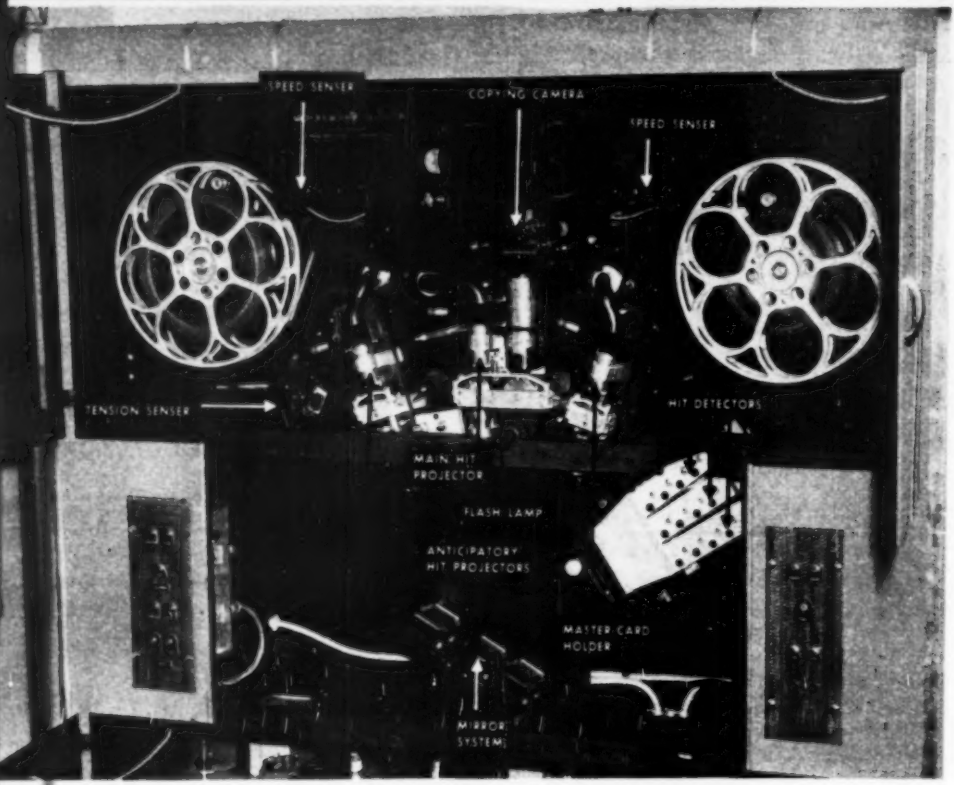
The machine at the Department of Agriculture in Washington is housed in a sleek gray cabinet about six feet high, eight feet long, and three feet deep. It looks like a de luxe air-conditioning unit. Yet it will store and classify material that, in its original form, would take 4,000 times the space occupied by the Selector and its file of film.



To extract particular information, its code pattern is punched out on this master card. When pattern on film corresponds to card, the machine knows it's time to take a picture.

The Rapid Selector is shown below with the doors of the working section open. The machine can operate with the film running in either direction. Film tension is kept at eight ounces.





Close-up of working section. Light from "hit" projectors passes through coded area, is reflected through mask onto detectors. When film pattern matches mask, flash bulb lights, taking picture.

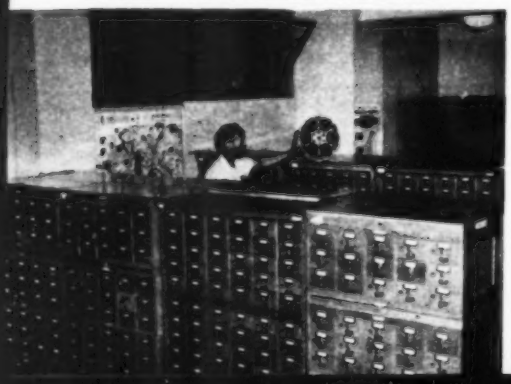
There were plenty of bugs to lick during its development. For example, the flash lamp that snaps the selected pictures flashes for only two-millionths of a second. This effectively "stops" the film's action and eliminates the need for a shutter on the copying camera.

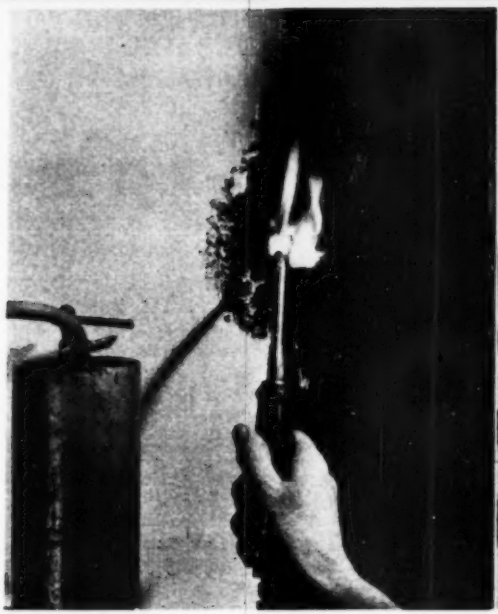
The system worked fine as long as the frames selected for copying were a few inches apart. But if they were too close together, the copying film couldn't move fast enough to get its second frame in front of the camera in time. A second electric-eye scanner solved the problem. It senses when a double exposure is likely to occur and automatically slows down the file film. After the second frame has been copied, the machine resumes its normal speed.

Literally, the Rapid Selector is a librarian's dream—the librarian being Ralph R. Shaw of the Department of Agriculture. Shaw supervised construction by Engineering Research Associates, of St. Paul, Minn. The Office of Technical Services, Department of Commerce, footed the $75,000 bill.

The result is an approach toward realization of an idea advanced some years ago by Dr. Vannevar Bush, who was director of the wartime Office of Scientific Research and Development. Dr. Bush visualized a desklike device called the Memex. Press a button and the dope you want would be projected on a screen in front of you. It seemed a little far-fetched then, but now the Rapid Selector does almost that. And it's only a comparatively crude prototype. Its developers say improvements are already in the mill. END

The reel of film in the operator's hand contains the same amount of data as all seven of the card-file cabinets shown in photo below. The machine can scan a reel in less than seven minutes.





Paint Swells to Stop Fire

A NEW fire-retarding paint that looks like thin varnish may soon be available for such indoor jobs as protecting basement ceilings and airplane interiors. Under heat it fluffs up like a toasted marshmallow, forming a spongy insulating layer more than an inch thick. The photos above show how Coating X® (white side) protects a wood panel from a torch flame for 20 minutes while the lead-painted black side is burned through. The new paint, a powder mixed with water, can be covered with ordinary paint. It is still experimental, reports Sherwin-Williams, which hopes to perfect it as an exterior undercoater.

Electronic Tester Culls Knobs

THIS electronic tester twists door knobs all day. If they do not slip on their shanks, they drop into the "accepted" box. If there is the slightest slippage, which would cause malfunctioning in use, an automatic gate flips the knob into the "reject" box. Photoelectric cells stop the device while the operator inserts a knob and start it again when he withdraws his hand. Yale & Towne makes it.

Tests Predict Tougher Shoes

SHOES that last 75 percent longer are predicted by tests of new impregnated sole leathers on the abrasion machine shown below. Researchers at the National Bureau of Standards found that leather impregnated with plastics or rubber showed much greater resistance to wear than untreated leathers. The improved leathers were tested by spinning them on the machine against an abrasive disk.

'Seater Meter' Samples Shapes and Tastes

EVERY day several University of Michigan students are taken for a ride. They don't go anywhere or do anything – just sit. But they're sitting in a fancy new device dubbed a "Seater Meter," and when a thousand or so have sat out their "rides," researchers hope to learn how automobiles can be better tailored to fit the collective anatomy of American motorists.

The Seater Meter is a dummy driving compartment that can be adjusted this way and that to accommodate the bodies and tastes of people of every size, shape, and personal prejudice. So far as is known, it represents the first scientific approach ever made to the problem of designing complete compartments for maximum convenience, comfort, and safety. Its objective is to arrive at basic dimensions, in terms of seats, floorboards, pedals, instrument panel and controls, and steering wheel, that will best fit the largest number of men and women motorists.

Officially known as the Universal Driver's Compartment, it is a project of the Marketing Research Department of the Ford Motor Co. It was designed by the automotive laboratory in the university's bureau of engineering research under authority of J. R. Davis, Ford's vice-president in charge of sales and advertising.

Collaborating in the research is Prof. Walter Lay who, as a member of the seating committee of the Society of Automotive Engineers, already has done much work on seating for automobile manufacturers. Findings bearing on safety may be made available to the entire industry for possible standardization in all makes of cars.

Professor Lay started out by collecting existing studies of the human frame. These included dimensions averaged out by the U. S. Air Force at Wright Field, Ohio, and by Dr. Ernest A. Hooton, Harvard anthropologist. Anthropologists and anatomists of the University of Michigan helped.

These studies resulted in a sort of baseline. They showed that something like 15 percent of all men are about 69 inches tall and that approximately 18 percent of all women are around 65 inches. These two percentages were the biggest single chunks in the study. They also appear to be about the over-all average.

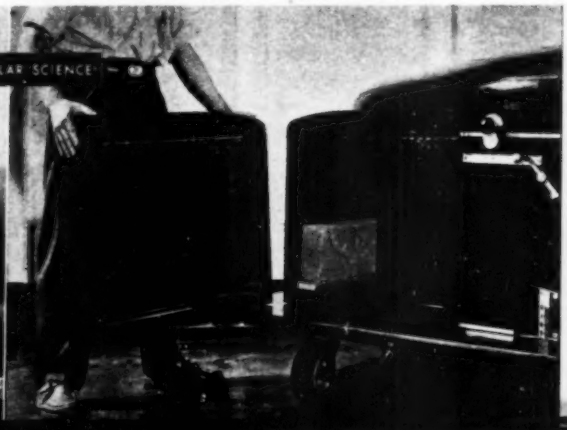
Then the Seater Meter was built.

When a POPULAR SCIENCE reporter took the test, he discovered that he preferred a flatter trajectory for the clutch and brake pedals than is customary in today's cars, that he liked the steering wheel lower, and that instrument panels and windshields were too far away.

Already the meter has turned up some

Fender silhouettes of various cars can be fitted on "Seater Meter" to determine road visibility from driver's seat. For easy maintenance, one set of socket wrenches unbolts entire unit.

Sides come off, together with seven other basic parts, for shipment. Except for metal fittings, motors, cloth seat, and calibrated indexes, device is made of wood. It weighs 1,800 pounds.



interesting information. Most subjects seem to like a tilted armrest—a flat armrest only rests the elbow. Many would like a stop on the right side of the accelerator pedal for a tired foot. They think the windshield should be closer to the driver and that footboards are too slanted for comfortable operation of the foot controls.

The meter shows that women are apparently able, through force of habit, to accommodate themselves to awkward driving compartments better than men. Many of them look through the steering wheel instead of over it, and most want the seat moved forward. It's their only way of achieving reasonable comfort and visibility.

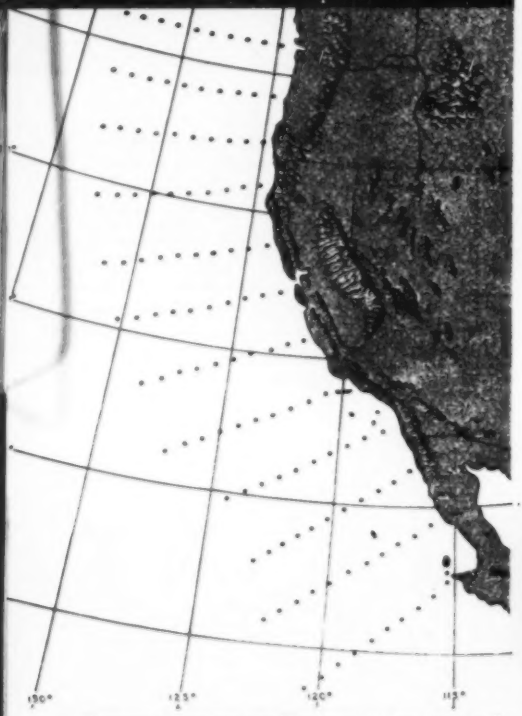
How can a single automobile be designed to accommodate such a wide variety of human tastes and torsos? The researchers aren't sure yet. But when a lot of people have finished sitting in the Seater Meter, they expect to have a pretty good idea. END

Four controls for altering slant of steering column and distance from driver are reached through hood opening. Device has 12 controls, 8 locks, some of which are spring-balanced

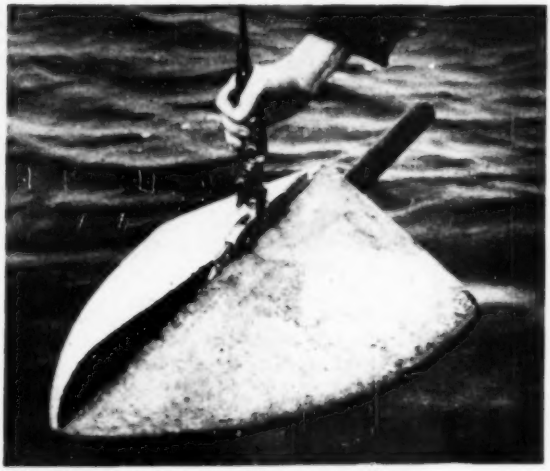
Four electrically operated columns, with solenoid limit switches, raise and lower seat and floor. Seat travels up and down 10 in.; floor, 8 in. Seat can be tilted up 20°; toeboard, 60°.

The Case of the Missing Sardines

CALIFORNIA has set seagoing detectives on the mystery of the vanishing sardines. The state's annual catch used to be 800,000 tons. In 1947-48, only 100,000 tons were taken. That means a loss of food and a loss of livelihood for a lot of fishermen and canners. So now several scientific and government agencies are co-operating in a giant fish hunt covering 670,000 square miles of the Pacific. By measuring water temperature and salinity at various depths, currents can be charted. Study of water samples reveals the distribution of sardine food. From these and other data the sea sleuths hope to discover where the sardines have gone.

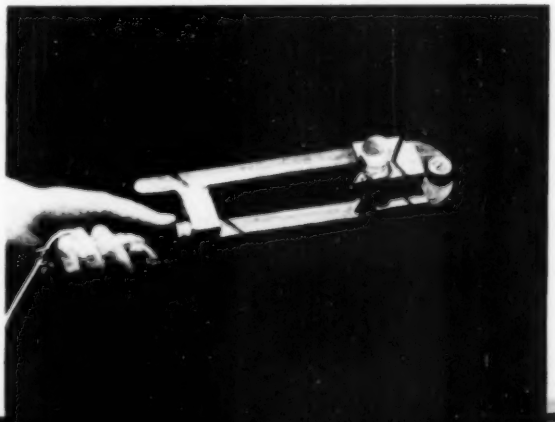


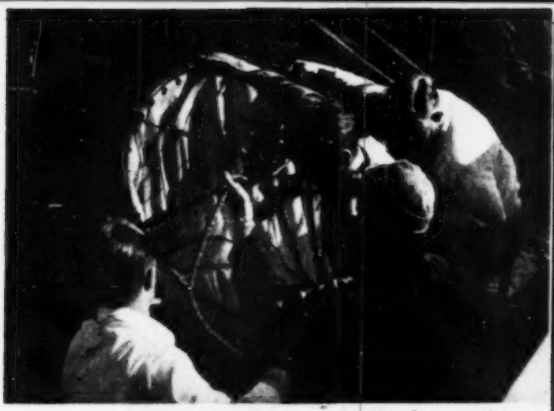
Former seagoing tug *Horizon*, at top, is one of six vessels that ply the Pacific in search of the missing sardines. Dots on map indicate points where observations are made every month.



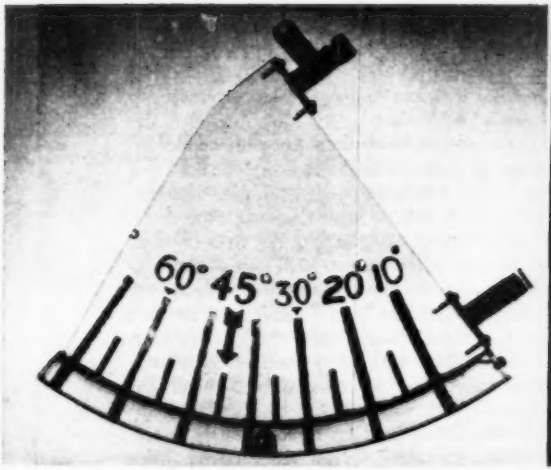
This 85-pound concrete object is an undersea "kite." Attached to a cable, it carries scientific instruments down and holds them at desired depths while under tow at four or five knots.

To permit quick attachment of instruments, balls of low-melting indium alloy are formed over the cable. Molten metal is poured into the casting tool while it grips the cable as shown in

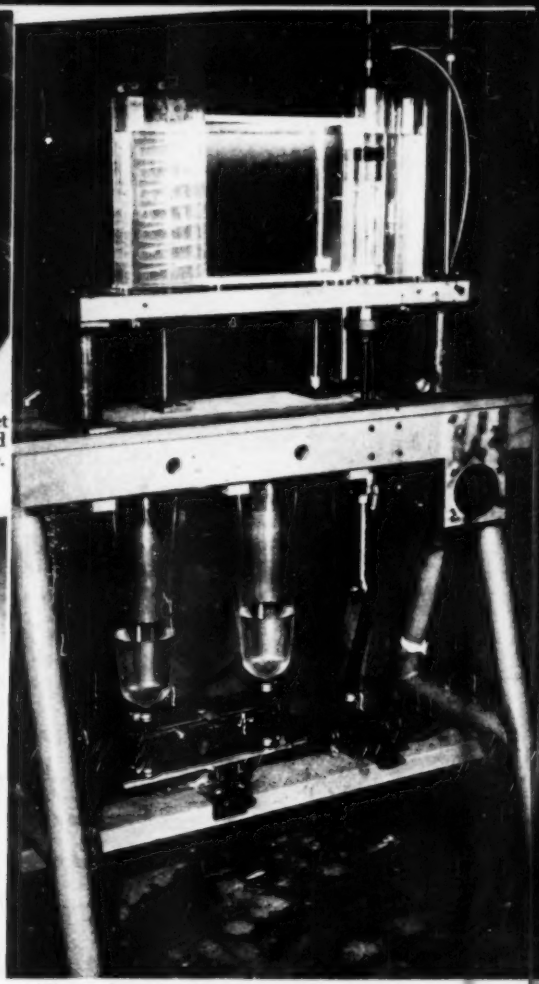




At the start of a run, scientists lower a dragnet that will gather samples of sardine eggs and other minute forms of sea plants and animal life. An instrument registers depth of catch.

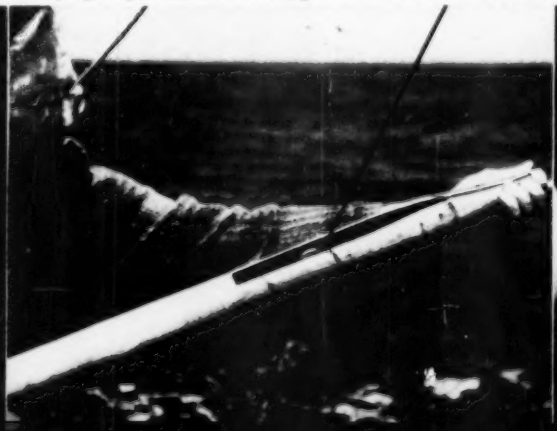


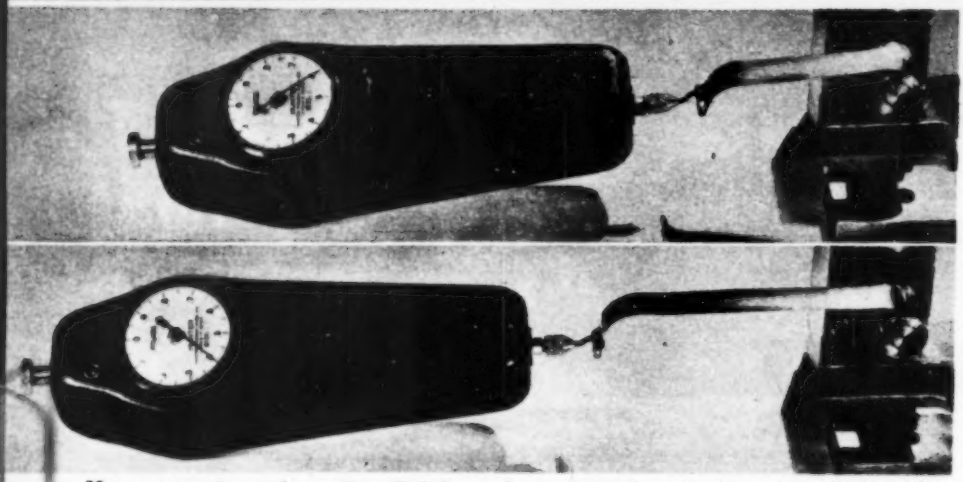
Angle of the tow cable is registered on this special inclinometer. The angle is read from position of the ball in the oil-filled, curved plastic tube seen at bottom of instrument.



The contraption above is an Elutriator (meaning it purifies by flow). It separates tiny animals and plant life, taken in a sampling, according to how fast they sink through moving water.

photo at far left below. Next photo shows the ball, formed in 10 seconds, and solid enough to stand a pull of 400 pounds. In the third picture, a scientist is clamping a split section of a dragnet's shaft over the ball. After a run, a chemically heated soldering iron, at far right, is fitted over the ball and melts it off in a few seconds, leaving the cable as clean as before.





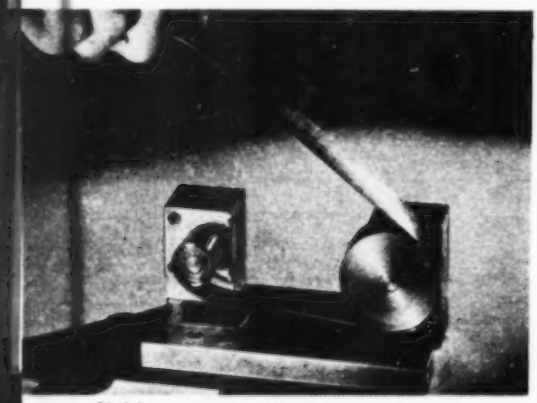
Meter at top shows .6 pounds pull, below only .4, although spring has unwound two inches.

Negative Spring Does New Tricks

THIS new spring breaks all the behavior rules.

The tighter you wind a clock spring, the harder the key turns. As you pull on a coil spring, it takes more and more force to stretch the coils a given distance. But the Neg'ator® can be made to become weaker instead of stronger as its load increases. Or it can have either constant or increasing tension, depending on how it's made.

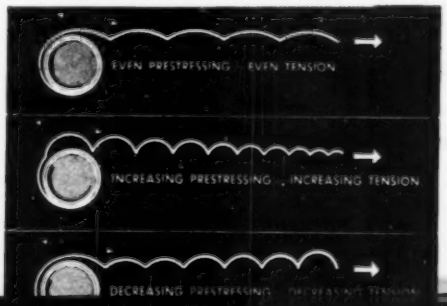
The Neg'ator begins as a flat strip of steel. Each successive section is prestressed a predetermined amount and the strip coils up like a steel tape. The force needed to unwind each section varies with the prestressing. Thus, if the free end is prestressed heavily and successive sections only lightly, the spring resists more at the beginning of the pull than at the end. Or if each section is prestressed the same, the pull will be even. Some uses are obvious. A conventional spring pulls a screen door hardest when it's open. But you want it to hold the door tightly shut. Using a Neg'ator, the pull can be greatest when it's shut, least when it's open. The new spring, made by Hunter Spring Co., can also be used to replace window sashweights; to make bookends, self-winding tapes, vises, telescopic tubes; and to wrap insulated pipes.



Unlike conventional springs, Neg'ator® can act around corners without loss or inaccuracy. Pull shown here, with spring around pulley wheel, is approximately 135° off normal line of action.

If wound on two spools of different sizes, the Neg'ator will run by itself from the larger to the smaller unless restrained. Picture below shows this action being resisted by a .78-pound pull.

Diagram shows how new spring can be tailored by varying prestressing. Since spring's action takes place only at coil (arrows), prestressing at that point determines pull of entire spring.



Ancient craftsmanship teams up with modern mechanics in manufacture of plated silverware.

How Your Knives and Forks Are Made

By George H. Waltz, Jr.

PS photos by Hubert Luckett

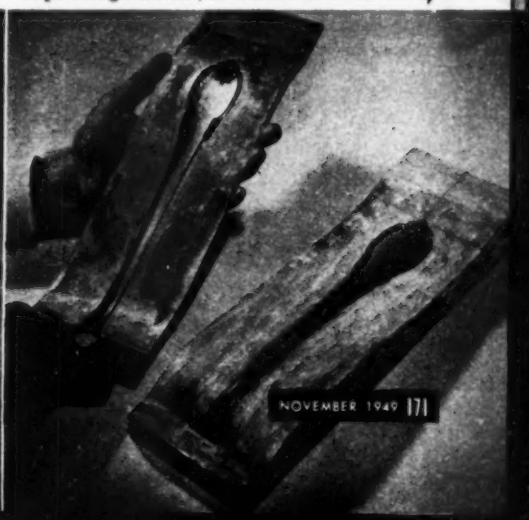
THE next time you sit down to your dinner table, take a good look at the knife, fork, and spoon that bracket your plate. If they are silver-plated, you will be looking at the product of a unique blending of the deft handwork of master craftsmen and the mechanical magic of modern mass production.

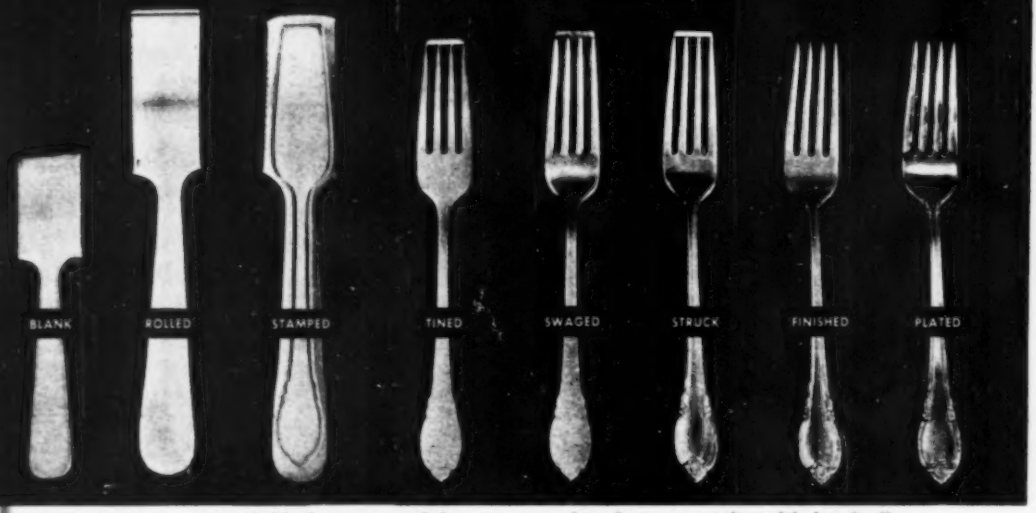
The trick of electroplating tableware with silver was perfected more than a century ago in the Hartford, Conn., basement workshop of the three Rogers brothers, who have since been closely associated with silverplate. Little, however, has ever been told about modern production methods. Fearful that special

After model has been approved, a large-scale drawing of the design is made, usually about three times actual size. From this an enlarged model is hand-carved in wax as shown above.

Working from artist's sketch, craftsman first makes hand-chased model of new design in metal. This must then get OK of production men, stylists, salesmen before going into production.

Wax model serves as pattern for mold from which large bronze master die is cast. This die, at left, is cleaned up by hand and used, in duplicating machine, to make actual-size die.





How a fork grows. Rough blank at extreme left is first grade-rolled to distribute metal so proper thicknesses are in proper places. Then form is stamped out, tines are punched in, curves of tines are swaged in, design is struck, and fork is finally plated. Cross-piece at the top of the tines is left in place in order to provide strength until all the forming operations have been completed.

trade secrets might leak out, silverware manufacturers have kept the public in general, and writers and photographers in particular, a good distance away from their production lines.

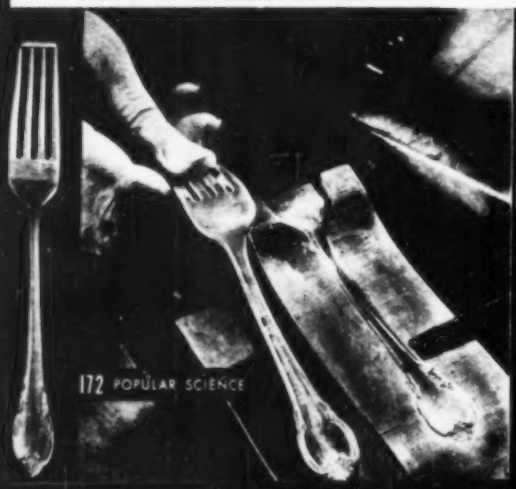
Now, however, with the co-operation of the International Silver Company, which bought the Wm. Rogers Mfg. Co. 51 years ago, PS is able to take you behind the scenes at one of the largest manufacturers of plated ware and show you just how your plated knives, forks, and spoons got that way.

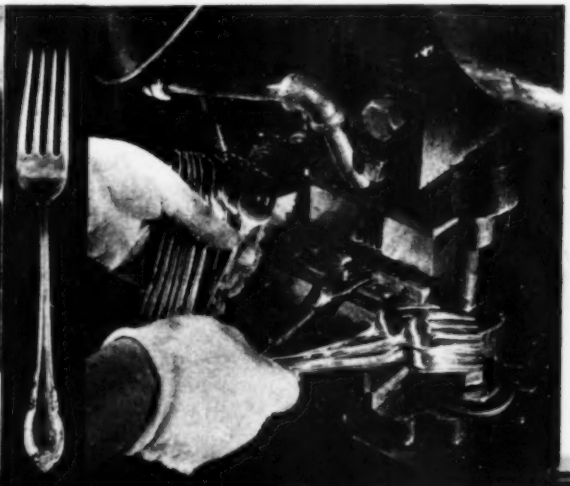
At the large, many-building ISC plant in Meriden, Conn., not more than 20 miles from the spot where the silversmithing Rogers brothers first succeeded in silverplating a metal cup, a new design for plated ware still starts out in the hands of master craftsmen. After an artist has put the original design down on paper, a skilled silversmith creates a full-size, hand-chased model. Then still another artisan literally sculptures a scaled-up model in wax to provide the pattern for a mold in which a large master die is cast in bronze.

After more handwork to clean up the design, the enlarged bronze die is placed in a duplicating machine. Here a rotating burr or cutter, guided by the bumps and depressions on the bronze master, cuts the design in its

Striking the design. Double dies, one in a 900-lb. drop hammer and another, shown below, in the anvil of the press, imprint the design on both sides of the fork handle with one blow.

When all forming operations are completed, the reinforcing bar left on the tines is cut off. These cutting presses, like the swaging and striking presses, are hydraulically operated.





Forks and spoons start down production line in this blanking machine. By cutting two interlocking blanks with each stroke, machine keeps waste scrap to minimum. Metal is nickel silver.

After blank has been rolled, stamped, and tined, swaging machine gives tines their graceful curves. A 600-lb. drop hammer containing male half of die forces the blank into lower, female die.

actual size into a block of steel. This first steel die, after still more handwork, becomes the master steel die. In preparing a new design for mass production, approximately 120 such original dies and special tools for stamping out the forms must be made.

Dies Do Job

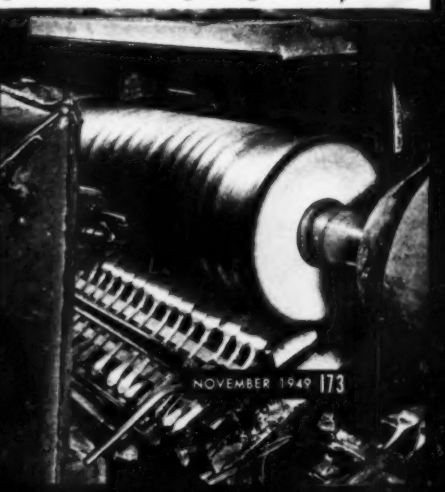
The production of good-quality plated ware begins with the production of these dies. It is their job in "striking" the designs into the base metal to reproduce the delicate handwork of the master craftsman who created the original patterns. Their surfaces must be kept clean, sharp, and crisp.

Under the continual hammering it receives from the blows of a drop-hammer press, the life of a die is relatively short. Under average conditions, it is good for about 80,000 impressions, which amounts to just a little more than approximately 22 hours of actual production use.

To cut a new steel die each time one wears out would be prohibitive in cost. Instead, replacement dies are made by forcing a hub or male die, made from the original steel die, into a block of die steel under the pressure of a giant hydraulic press. These rough, pressed dies are then worked over by hand by expert die makers, hardened, and cured

Among many trimming, finishing, and polishing operations is hand trimming of tines on emery belt. Sixteen separate operations are necessary to give metal blanks proper finish for plating.

After plating (page 176), forks are given final polishing. Automatic machines like one below do most of work. Special chucks hold plated pieces against double, rotating buffing wheels.



How a knife grows. Rough cylinder for each knife handle is drawn in successive stages from hollow metal tube. After cylinder has been swaged and stamped, design is imprinted in a drop-hammer press, the handle is trimmed and finished, the blade is attached, and the knife is plated.

before they are ready for use in the presses.

On the actual production line, knives, forks, and spoons start out in life as blanks of varying size, shape, and thickness that have been stamped out of flat sheets of nickel silver. This is an alloy containing 18-percent nickel, 18-percent zinc, and 64-percent copper. Once known as "German silver," nickel silver is the ideal base metal for plated ware. Because it is durable, easily worked, and resembles silver in color it is used almost throughout the silverplate industry.

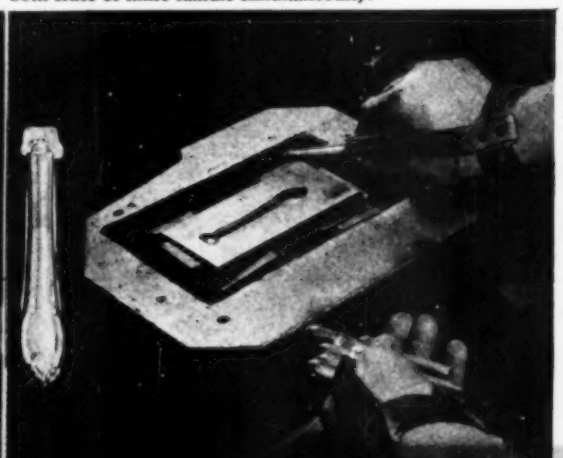
Fifty operations after being blanked out, a short, squat, paddle-shaped blank has become a silver-plated spoon. A longer blank, after about 51 operations, has become a fork. And, after passing through some 111 operations, a round, disklike blank and some blade stock have become a hollow-handle, silver-plated knife!

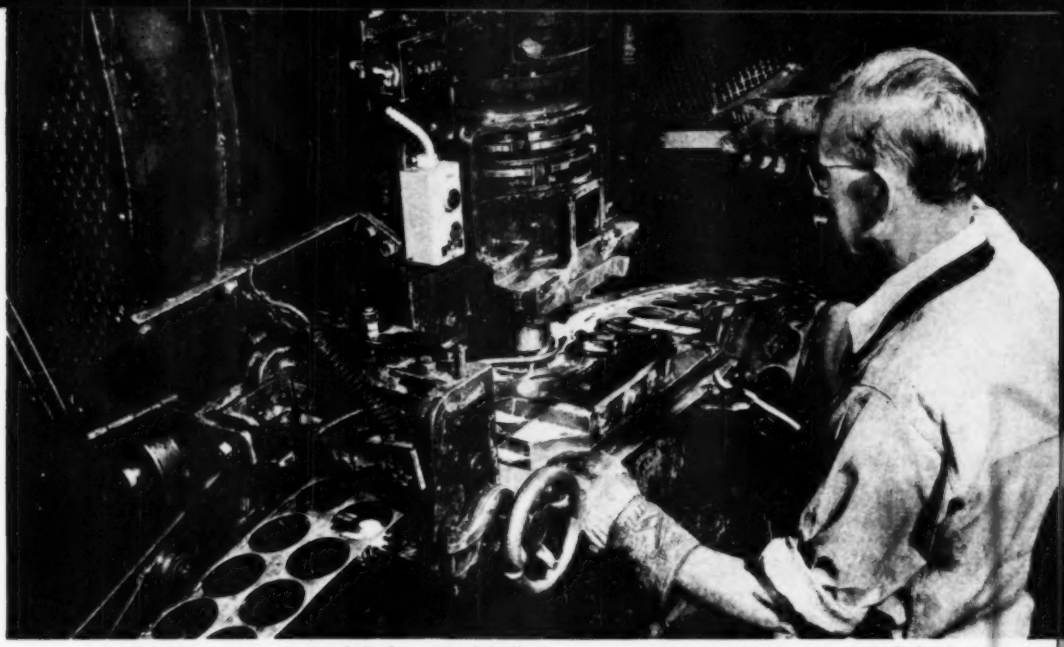
$30,000 Tanks

Before reaching the plating tanks, the blank, as it grows into a knife, fork, or spoon

In this swaging machine, cylindrical blank for handle gets first shaping. In next operation, it will be given handle shape in drop press. Note pail in foreground full of swaged handles.

Striking the design on the handle of a knife is done in a press similar to those used for fork and spoon handles. Double dies imprint design on both sides of knife handle simultaneously.





Drawing press cuts out disks from which hollow tubes for handle blanks are formed and makes first draw in one operation. Knife handles used on most of Rogers 1847 patterns made by International Silver Co. are seamless as compared with two-piece construction normally used.

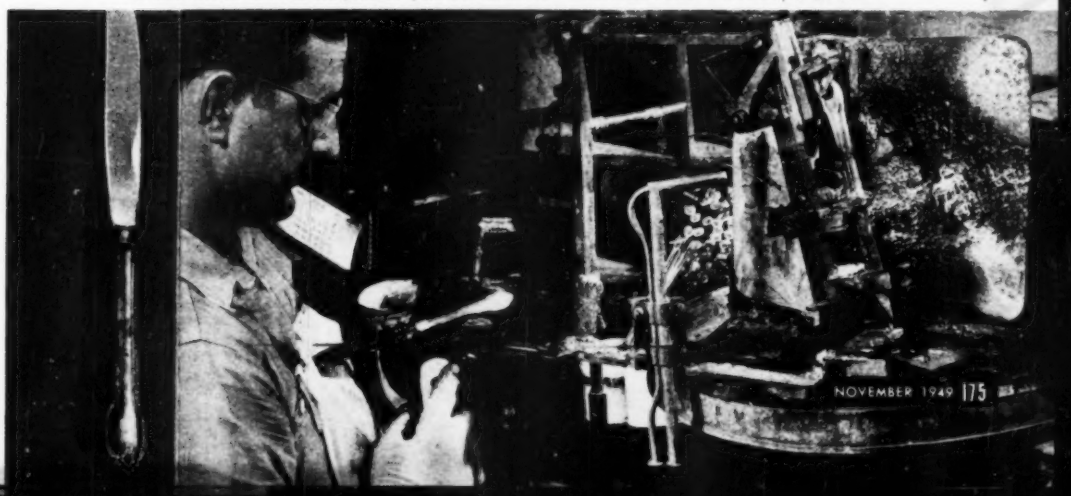
receives five general inspections plus one final inspection.

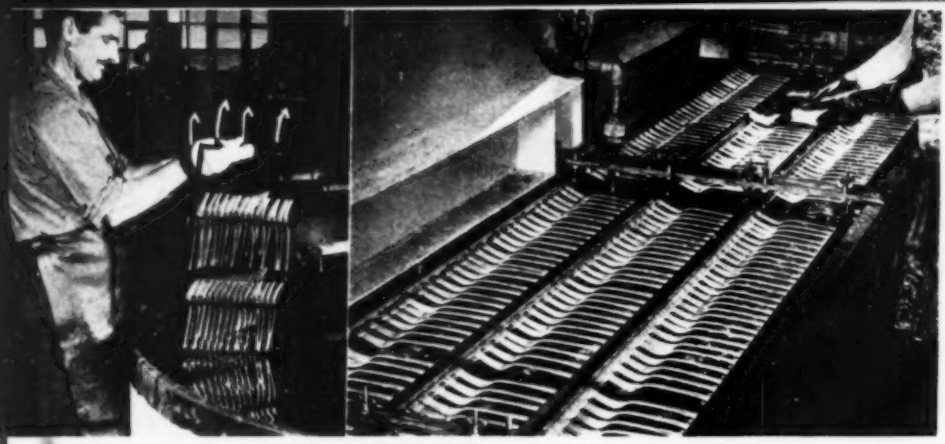
In the plating division, the blanks first are hung on racks and thoroughly cleaned in long automatic washers before they are immersed in the 35-foot-long plating tanks to receive their coating of silver. Freshly loaded with silver bars that serve as the anodes in the plating process, each of the three plating tanks contains approximately $30,000 worth of the metal.

No precious silver is lost in the ISC plant. When floors are washed, the wash water is collected, and the stray silver is reclaimed. When new floors are put in, the wood from the old floors is burned, and the silver is refined. Not long ago, enough silver was recovered from the wood in a floor that was being replaced to pay for the complete cost of the new flooring!

Once the plated ware has received its final luster finish by careful polishing, it never again is touched by a bare hand until it is used by the customer. All inspectors, wrap-

Next step is assembly of knife handle and blade. Knife blade is soldered into handle in automatic machine that electronically times heat required. When solder has melted, knife (shown in jig at right) swings out and away from the heat of the flame. While solder is still soft, worker smooths joint with gloved finger the way a plumber hand-smooths a soldered pipe joint.





Plating operation is timed according to thickness of silverplate desired. Racks of silverware are hung on arms that carry them around 35-foot-long plating tanks (at left). For extra thickness at points of greatest wear, such as spots where utensils touch table, pieces are placed in spot-plating bath (right). Here only contact points touch plating solution.

pers, and packers wear cotton gloves to avoid the possibility of fingerprints that might damage the final finish.

Since sulfur is the arch enemy of any kind of silverware, whether plated or solid, all wrapping papers, cloths, and the materials used in manufacturing silver chests are carefully chosen for their sulfur-free qualities. By eliminating sulfur and any of its compounds, tarnish is kept at a minimum.

If you own silver-plated tableware, take care of it. If it is of good quality, it is the product of the careful handwork of skilled craftsmen. And it is coated with a silver finish that is designed to last a lifetime—and then some. END

How to Care for Your Silverware

THE best way to keep silver—either plated or solid—bright, is to use it. That means it is continually clean and free of tarnishing sulfur.

Don't use abrasive soaps.

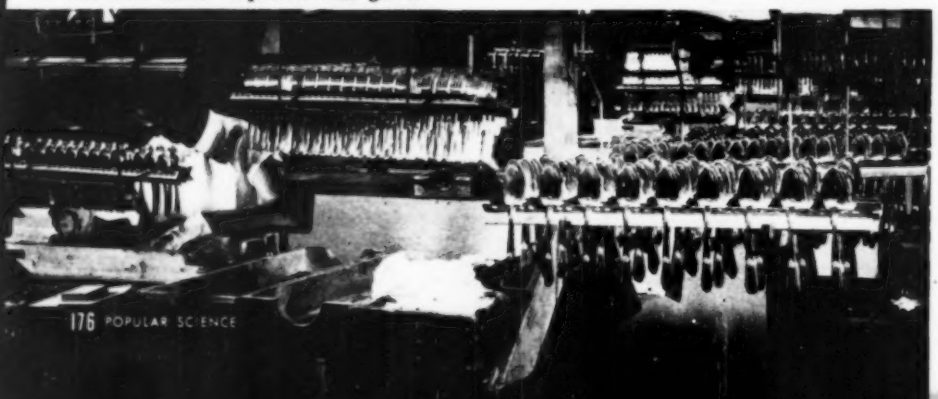
Don't boil your plated or solid ware in a solution of a highly alkali soap in an aluminum pan to clean it. This amounts to a reverse plating process that will gradually remove silver along with the tarnish.

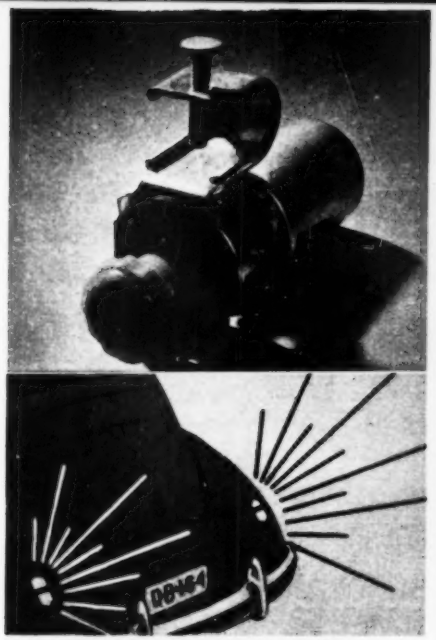
Wash frequently in hot water and ordinary soap suds and carefully rinse. Soap left on any silver surface tends to tarnish.

Wrap pieces used only occasionally in sulfur-free tissue and store them in a chest or drawer that is as nearly airtight as possible. This will keep sulfur-bearing fumes from the silver, and prevent unnecessary contacts with substances that might tarnish it.

Occasionally, silver and plated ware should be given a thorough cleaning with a good polish.

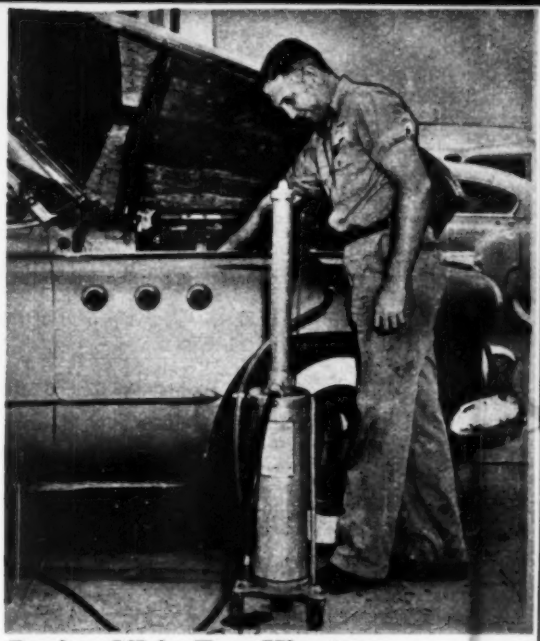
Careful inspection is given finished silverware before final wrapping in sulfur-free tissue paper. Cloth is used to shield surfaces from light so that even smallest imperfections will show up. Most harmful silver-tarnishing agent is sulfur, found in coal fumes, gas, rubber, soot, and moisture from hands. Inspectors wear gloves.





Stop Lights Flash Warning

A COMPACT unit clamped to the dashboard converts stop lights to flashing warning signals for use when you stop on a highway. Protect-O-Flash®, manufactured by United Accessories Corp., New York City, also may be connected to blink taillights or parking lamps. The dash unit includes a telltale to remind you it has been turned on.

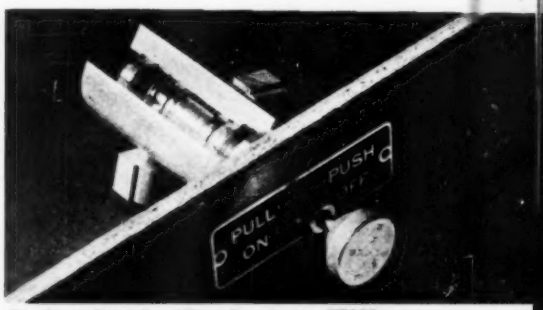


Drains Oil in Two Minutes

OPERATING from a filling station's air line, the Jiffy Oil Drainer® empties a crankcase through an ejector tube inserted in the dipstick or oil-filler opening. Faster service and less congestion at the pits or lifts are said to result. The unit, distributed by Allen-Sims of Miami, is priced at about $100. It weighs approximately 20 lb. and is 40" tall.

Switch Disconnects Battery

WHEN the Safety Master Switch® is pulled, the battery is disconnected from a car's electrical system—as if the battery were removed from the car. Fire and theft protection, and longer battery life, are advantages claimed. The switch, shown above, is mounted near the battery, preferably under the hood. A Bowden-wire control runs to it from the dash or from a hidden spot. It's made by R & C Mfg. of Penna., Inc., Ramey, Pa.



Valve Locks Brakes on Hill

INSTALLED between the master cylinder and the wheel cylinders, Sharp Brake® acts as an emergency and auxiliary parking brake. After brakes are applied, the dashboard button is pulled out. This holds fluid in the lines, locking the brakes. It holds the car for starts on hills and prevents creeping at traffic lights. Pushing the knob releases the brakes. The maker is the Sharp Manufacturing Co., of Nelsonville, Ohio.

Even a lawyer can be a wise guy when he wins too often. This case never went to trial, but Gus won a unanimous decision for Stan.

Gus Wins a Bet

By Martin Bunn

LEMUEL GASKINS, lawyer and solid citizen, stood in his garage and stared at the engine of his car.

"Hello," called a voice from the doorway. It was Bill Witte, Lem's neighbor.

"Come in," Lem answered.

"Just returning the soldering iron I borrowed," Bill said, stepping into the garage.

Gus led the way to the bench where he'd been working. One wire from a battery was bolted to the starter motor.

"Having a little trouble with the old bus?"

"Carburetor trouble. Engine coughs, spits, and misses when I accelerate."

"Could be the fuel pump," Bill suggested.

"No," Lem said with finality, "it's the carburetor."

"What makes you so sure it's the carburetor?"

"I know it is, that's all," Lem said flatly. "Want to bet?"

There's one in every town—a know-it-all guy who's always right, or at least thinks he's always right. That's the big difference between most of them and Lem. He's got the right answer 99 percent of the time.

"No," Bill replied, "I don't want to bet."

Lem's a notorious sure-thing bettor. Bill, as well as a lot of other people, knows it from experience. Lem likes to think of himself as well-informed. He uses that legal-eagle brain of his to dig up all facts on a particular subject and then he goes looking for a victim to bet with. The average guy, who picks up his misinformation from something he thinks he read or heard, doesn't stand a chance with Lem.

"I'm willing to bet anybody that it's the carburetor," Lem went on.

"Maybe so," Bill said. "As a matter of fact, I don't much care but I still think it could be the fuel pump."

"You want to bet on that?"

"No, no bets."

"I've already checked the pump. It works perfectly," Lem admitted. He picked up a screwdriver and began removing the plate over the float.

"Carburetors are pretty tricky things to take apart," Bill said. "I tried it once and wound up lugging the whole thing to the Model Garage."

"I know what I'm doing," Lem said.

"Well, good luck," Bill grinned. "I think you're going to need it. I got to go."

Lem was glad Bill left. It took him only a few minutes to discover that he didn't know what he was doing, and he didn't want anyone to find that out. He pictured himself walking over to Bill's house with a pan full

of carburetor parts and asking Bill to drive him to the Model Garage. He shuddered and put the thought out of his mind.

After he had replaced the cover plate, he tried the engine. It caught and idled smoothly but still spluttered and missed when he raced the engine. Probably something wrong with the high-speed jet, he thought. He decided he'd have to go to a repair shop after all.

By handling the accelerator very gently, he managed to make it to the Model Garage. On the way, though, he tried speeding up in hopes that the trouble would have cleared up. But each time he stepped on the gas the engine coughed and bucked.

It's the Carburetor, He Says

When he drove into the shop, Stan Hicks looked up and scowled.

"Clip anybody lately?" Stan asked. A couple of weeks before, Lem had stopped for gas and managed to maneuver Stan into a half-dollar bet that Stan lost.

"Never mind that," Lem grinned. "Something's wrong with my car. It runs all right at low speeds but when I speed up it sputters and misses. Some minor carburetor trouble. Dirt, probably. Check it but don't go trying to blow it up into a big job."

"Here's the boss," Stan said. "Tell him your troubles."

Lem repeated his story to Gus.

"Why do you think it's the carburetor?" Gus asked. "A fuel pump that wasn't working right could make an engine act like that."

Funny, Lem thought, how everyone wanted to blame the fuel pump. He was dead certain there was nothing wrong with the pump. He couldn't resist the opportunity to work up a small, sure-thing bet.

"Well," he told Gus hesitantly, "I guess you're right. It *could* be the fuel pump. But I still think it's the carburetor. What say we have a little fun out of this? I'll bet you two bucks it isn't the pump."

"Nothing doing," Gus grinned. "Knowing you, I'd say you just had the pump checked or else had a new one installed."

"No, I didn't," Lem protested. "That's the same old pump and I didn't have it checked." He realized he was skating pretty close to the line between a lie and the truth. But after all, he told himself, it wasn't a new pump and he hadn't had anyone check it. He'd just checked it himself.

"Take a seat in the office," Gus said. "Stan and I'll take the car out for a little run."

On the highway, the car ran smoothly enough at low speeds, just as Lem had said. But when Gus accelerated, the engine began to miss. He pulled off on the shoulder and stopped. Gus raised the hood and took a screwdriver from his pocket. He held the screwdriver with the blade near one of the plug terminals. When he pulled the throttle linkage, the engine started to pick up, and then sputtered. Gus got back in the car.

"Find out what's wrong?" Stan asked.

"Not definitely," Gus admitted, "but I found out what isn't wrong. It's not the fuel pump and it's not the carburetor. The trouble is somewhere in the ignition. If you want to get your half dollar back from Lem . . ."

"I sure do," Stan said quickly, "and with something added, too."

Lem popped out of the office as soon as Gus drove the sedan into the shop.

"What's the matter with it?" the lawyer asked.

"I haven't checked thoroughly yet," Gus answered, "so I can't say exactly."

"It's the carburetor," Lem snapped. "I'll bet it is."

"Okay," Stan cut in, "I'll take that bet. I say it's not the carburetor. Five bucks."

Lem shot Stan a sharp glance, hesitated, and then agreed to the bet.

"It's a bet you're going to pay – for a change," Gus laughed.

"We'll see about that," Lem told him.

"There's nothing the matter with the carburetor," Gus said. "The trouble is somewhere in the ignition system."

"Says you," Lem scoffed. "Prove it."

What the Meter Shows

"That's just what I'm going to do right now. Get the low-reading voltmeter, Stan."

After switching on the ignition, Gus raised the hood and made sure the distributor points were closed. When Stan brought the voltmeter, Gus held one prod on the battery-cable terminal of the starter and the other one on the battery connection of the coil. The instrument registered a drop of only a tenth of a volt. A check of the distributor-ground connection showed the same slight drop.

"Primary circuit seems okay," Gus said.

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky – if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

"Why the heck don't you check the carburetor?" Lem yelped. "That's where the trouble is. You're just running up a big bill. Even when I win the bet, I'll still lose when I've paid you. I won't stand for it."

Gus grinned at Lem and went right on checking. He examined the terminals of the high-tension cable from the coil to the distributor, and then the spark-plug cables.

"Hey, boss," Stan whispered nervously, "don't forget I've got a bet on you."

"The money's as good as in your pocket," Gus answered in a low voice. "On the highway, I checked the spark with a screwdriver. When the engine is speeded up, the spark cuts out. That's what causes the missing."

"What are you two whispering about?" Lem demanded. He came around the car to where Gus and Stan stood. "Trying to cook up a deal so I'll lose that bet?"

Gus didn't answer. He just grinned and started going over the wiring again. After another minute or so, he laughed.

A Little Bare Spot

"Here it is. Take a look, Lem."

Gus bent up one of the primary wires running to the ignition coil and pointed to a tiny bare spot where the insulation had worn off. Lem looked.

"Sure," he conceded, "there's a little bare spot. But what of it? It's a quarter inch away from the engine block, so how could it cause a ground? Besides, the car runs fine at slow speeds. It's just when I accelerate that it acts up. If that bare spot caused a short, why wouldn't it do it at low speeds as well as at high speeds?"

Gus wrapped a few turns of tape around the worn spot.

"Satisfy yourself," he told Lem. "Drive up the highway. Then come back and I'll install a new wire."

The lawyer was gone almost 15 minutes.

"Well?" Gus asked him when he returned.

"No trouble," Lem admitted grumpily, "but you haven't proved anything yet and until you do, I'm not paying off."

"Leave the engine running," Gus said, "and take a look."

Lem hopped out of the car as Gus raised the hood and peeled the tape from the wire. He pushed the wire back to its original position. Then he took hold of the throttle linkage and abruptly opened her up. As the engine picked up speed, it shifted slightly on its rubber mounts and the engine block swung into contact with the wire. The engine instantly spluttered and coughed.

Payoff

"So what?" Lem demanded.

"The answer," Gus said, "is torque. That bare spot does no harm as long as the engine runs slowly. When the torque is increased by acceleration, it moves the engine on its mounts. The move is only a slight one, but it's enough to bring the block into contact with the bare spot. That causes a short. The short ends the torque. The engine shifts back. That ends the short and the engine picks up again. Watch this."

Gus led the way to the bench where he'd been working on a starter. One wire from a battery was hooked to the starter.

"Now," Gus said, "you'll see torque in action when I touch this other wire to the starter case. The force of the motor turning will roll the case in the opposite direction."

He touched the wire to the case. The motor whirred and the case twisted as it tried to roll across the bench top.

"Catch on?" Gus grinned.

"Oh, all right," Lem agreed. "You win." He was counting out five one-dollar bills into Stan's palm when a car drove into the shop. It was Bill Witte. "That makes five," Lem whispered, "and here's an extra one. In case he asks, I'd just as soon Bill thought I had carburetor trouble." END

They look like junk, but in the hands of Leo Bertelsen these cars will get a new start in life. Shown here are four Cords, a Duesenberg (at the left in back row), and an old Studebaker.

Good Cars Never Die

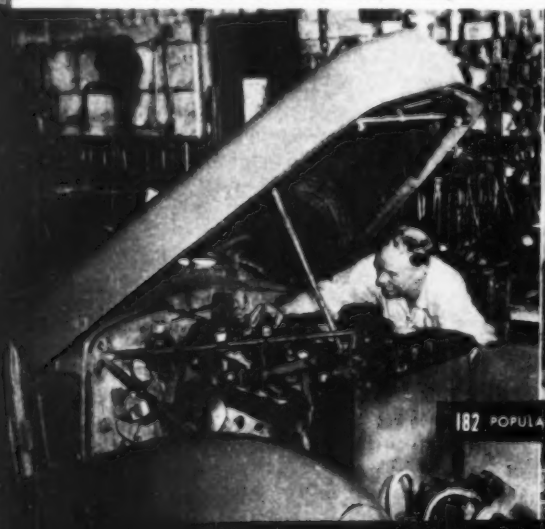
That's the working philosophy of Leo Bertelsen, former race mechanic who rebuilds many fine cars of the past.

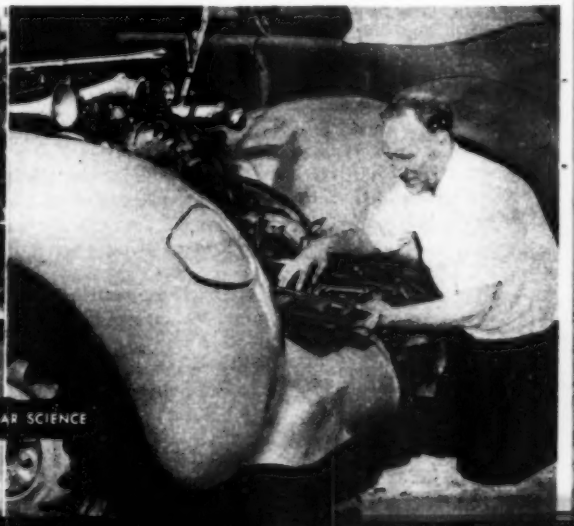
By Murrelle Mahoney

SOME of the finest cars in the West are overhauled in an unpretentious one-man garage in San Francisco. The secret is the man who runs it, Leo Bertelsen. A mechanic's mechanic, he has an unusual knack for rebuilding high-performance autos.

Bertelsen's start in the footsteps of Gus Wilson was inauspicious. At the age of 12, he

Cords are the specialty of Bertelsen's repair shop. Although all of these cars are now at least a dozen years old, roadworthy examples still command a stiff price. Here, Bertelsen checks over the V-8 engine of one job (left) and the front-drive transmission of another.

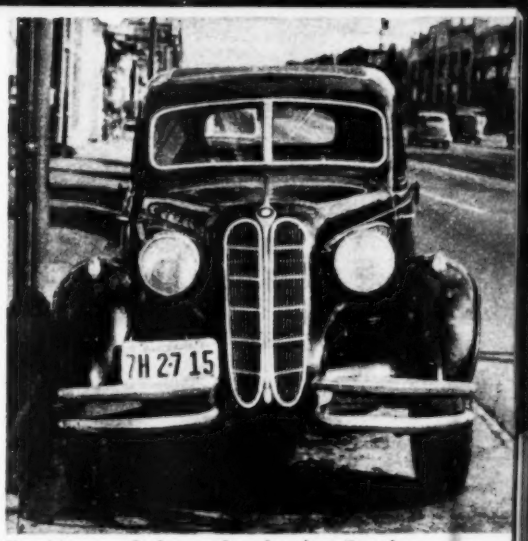




dragged a broken-down motorcycle into his living room and set out to make it run. He finally succeeded—and it promptly caught fire, burning up half the house.

This might have discouraged some youngsters, but it didn't stop Bertelsen. He has been repairing, rebuilding, and re-engineering gasoline engines ever since. In his shop you're apt to find a model of almost any high-quality car that's ever been made in America or Europe—Cord, Duesenberg, Alfa Romeo, Fiat, and Mercedes-Benz, to name just a few. Some look like junk. A few are museum pieces.

But whatever their condition on arrival, chances are they'll take the road again—or at least all except the few that Bertelsen must tear down to build up his stock of spare parts. But Bertelsen doesn't rely entirely on such spares. He resorts to a lot of improvising too.



Foreign cars find a ready sale when Bertelsen reconditions them. The prewar B.M.W. above has a six-cylinder overhead valve engine.

Duesenberg Is His Pet Project

When a Duesenberg comes in, it's like old home week for Bertelsen. And for good reason. During the Twenties he worked as mechanic for a Duesenberg racing team that set a number of speed records.

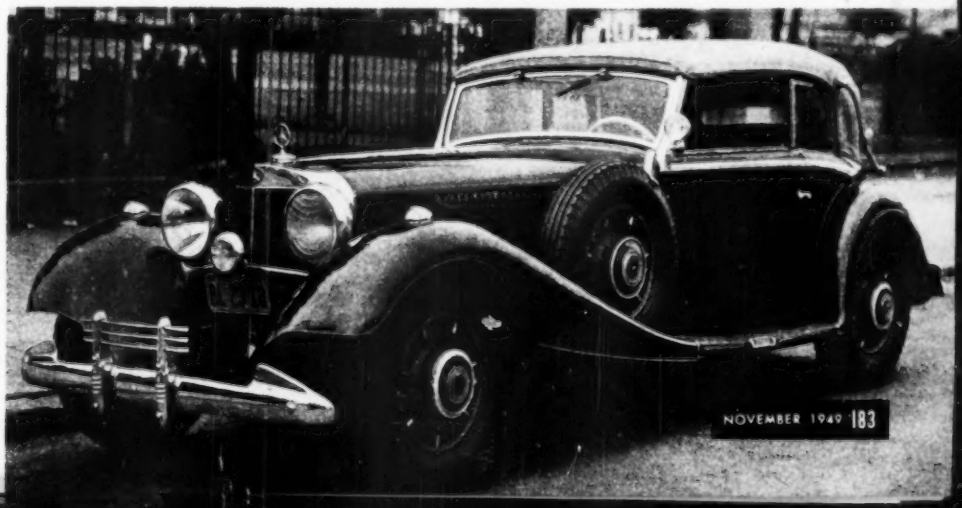
After this experience, it's easy to understand that Bertelsen would chose a Duesy as his personal car. At present it's not on the road. It's still torn apart, as it has been for nearly two years. It's Bertelsen's pet project for spare time—and there isn't too much of that.

Bertelsen believes this car may do close to 200 m.p.h. when he gets it in running order. He has rebored the cylinders from 3¾" to 3⅞", chromed the cylinder walls, and plans to use high-domed pistons of special design. Sodium-cooled valves of the largest possible size are to be used and all ports have been highly polished and chromed. To reduce friction, the wrist pins and con rods run on roller bearings.

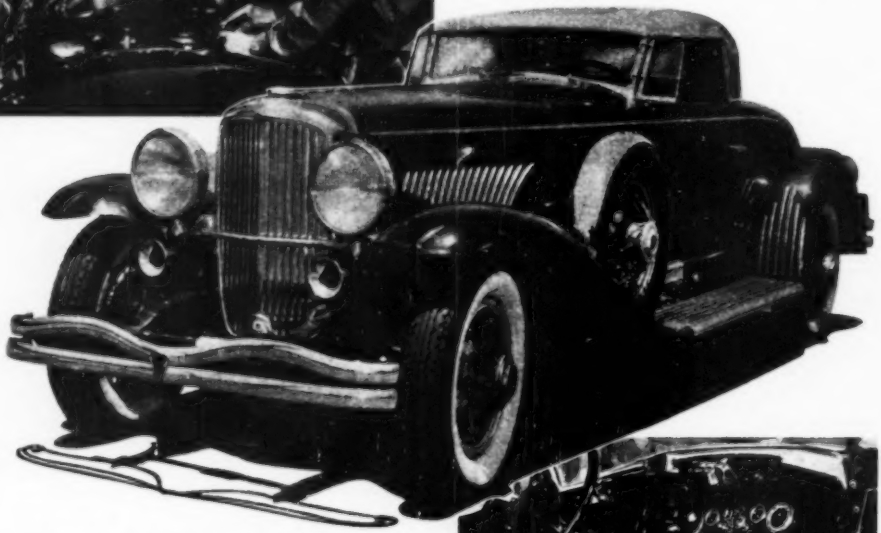
Because of the increase in horsepower, the Duesenberg transmission might not stand up. For this reason, Bertelsen will install a five-speed bus transmission.

All of this, however, is just play for Bertelsen. His major business is rebuilding Cords. He buys up practically all of these he can and reconditions them for resale. Orders far exceed the supply. At one time recently, he had orders for 12 convertibles.

Mercedes-Benz stands ready for the road again after a Bertelsen repair job. Combining the names of two famous European manufacturers, this supercharged car is said to do about 120 m.p.h. A pointed radiator shell has been a Mercedes styling characteristic since 1910.

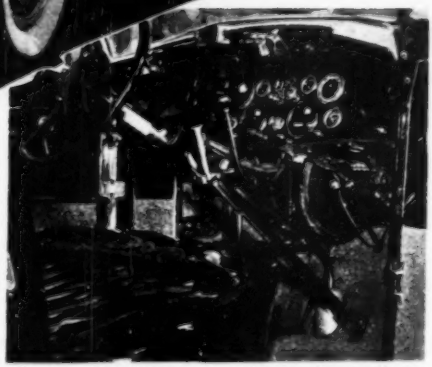


Duesenberg roadster below cost $36,000 when built as a special job in 1937. At left, Bertelsen adjusts its carburetor after a recent overhaul. Just above his hands you can see the carburetor warmer, one of many unconventional features found in the Duesenberg Straight 8.



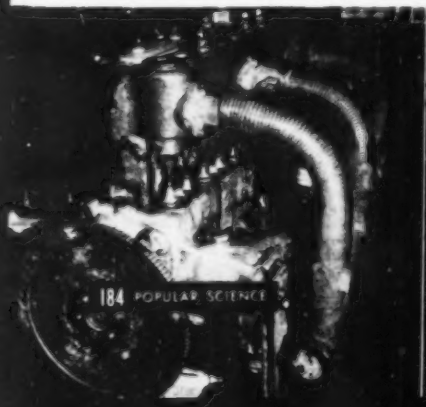
The Cord electric gear shift often gave trouble, but Bertelsen believes he has licked this. With the help of an electrician, he made a blueprint of the intricate wiring that controls the gears. After considerable study and trials, he succeeded in reducing the wiring by approximately half. His system now gives immediate and positive gear control when the driver operates the lever.

Other improvements include a redesigned universal joint and substitution of needle bearings for the bronze bushings on all the transmission gears. END

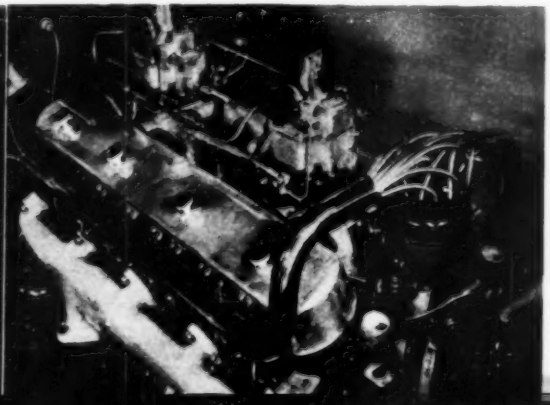


Dashboard indicators on a Duesenberg tell you just about everything, including the altitude. A light signals when you need crankcase oil.

A Mercer engine of unique design is owned by Bertelsen. It was manufactured in 1916 for racer Eddy Pullen.



Marmon V-16 engine undergoing overhaul is an example of huge power plants sometimes used in the old days. Note two carburetors and plated tubes for distributor wires.



Mechanics and Handicraft

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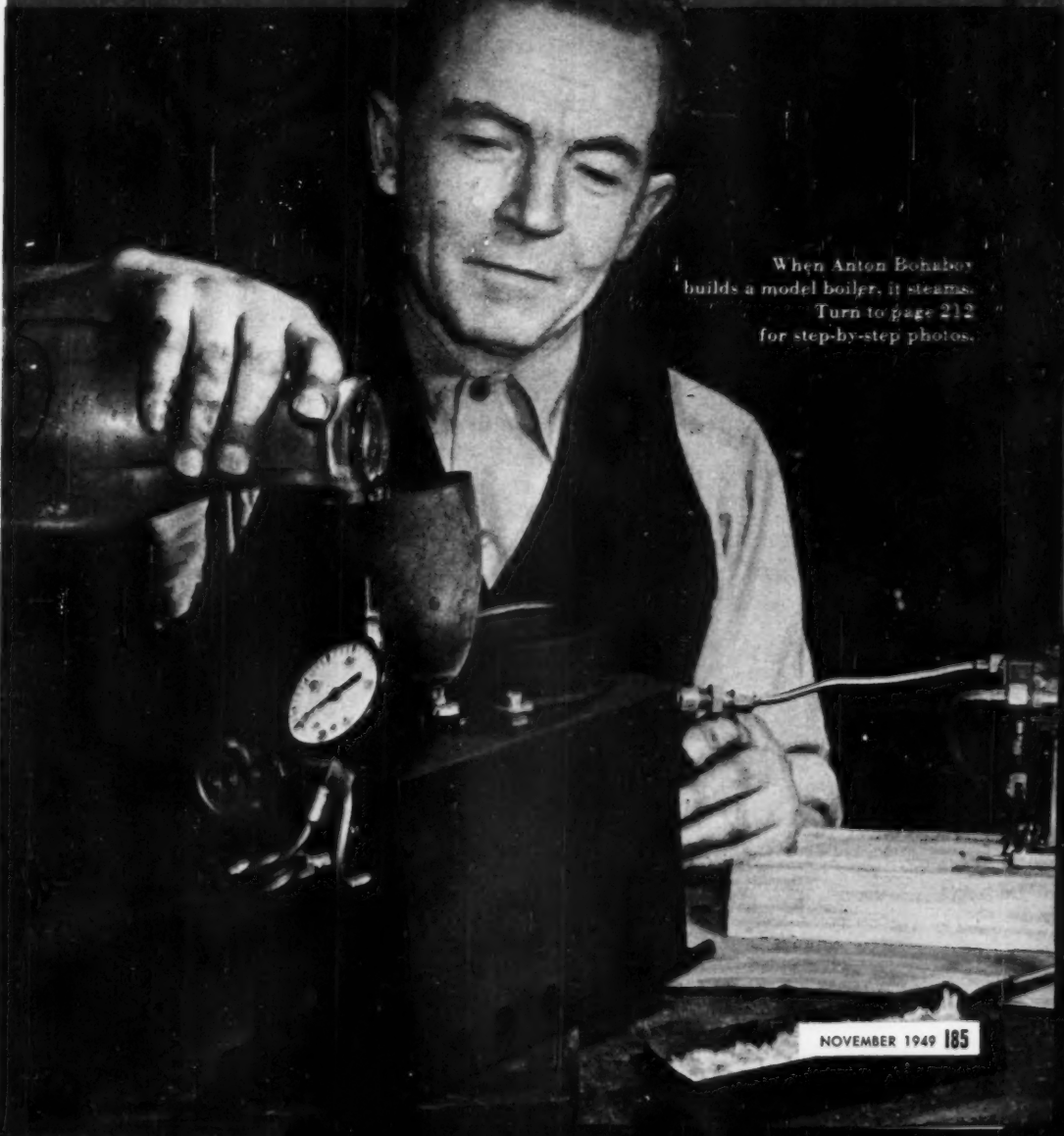


When Anton Bohabov builds a model boiler, it steams. Turn to page 212 for step-by-step photos.

Want to Run a Bulldozer?

Every sidewalk superintendent from 7 to 70 hankers to get his hands on this job. Here are full directions for making it.

Make it Now for Christmas

By Andre C. Lampert

THAT baby bulldozer cavorting on the floor at the left performs all the maneuvers of the real thing. What's more, it does them the same way. By working controls that correspond to the standard ones on a regular bulldozer, you can make it climb hills, dodge obstacles, bulldoze small objects, haul a load, and start, stop, back up, or turn on a dime.

"More fun than an electric train," you and the kids will say. (When you give it to Junior, better get yourself an extra set of batteries so you won't run his down.)

Here's how to make it:

Drive. You need two identical worm-and-gear sets. As these will determine dimensions, you'd better get them and the motors first. The gears I used came from the oscillating mechanisms of two old electric fans. They have a 1 to 44 ratio (the worm makes 44 turns while the other gear makes one). Similar sets for model locomotives can be bought at hobby shops, but don't settle for a ratio lower than 1 to 40.

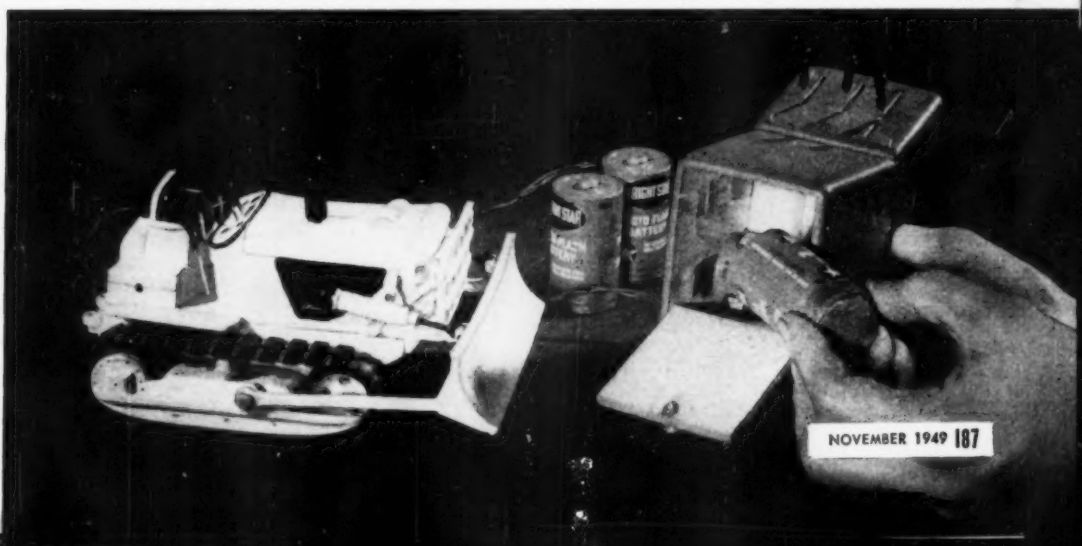
The motors are the permanent-magnet DC type in a plastic housing. They should be identical to run at the same speed. Put them down close together and measure the center-to-center distance between their shafts. This will be the spacing of the worms in the drive frame, which is bent up from stiff copper or other sheet metal. The pattern given is only approximate; you'll have to space the holes to suit your gears. It pays to be finicky here, even if you have to throw away your first frame and make another; for unless the gears are well meshed, they'll be power thieves.

For the front-end bearings, solder short bits of brass tubing into the frame. Washers fore and aft help reduce friction.

Into the outer face of each gear, drill a hole ¼" from center and solder in a short stub of ⅛" rod as a drive pin. Then solder the gears to separate short shafts. Slip them into bearing tubes in the frame and secure by a washer soldered to each shaft inside. Be sure they don't touch each other at any point; the two shafts must revolve independently. The gear sets should work equally freely. If they don't, a little judicious bending of the frame may help.

Chassis. Check the dimensions of your motors and drive frame before starting. Cut two sides to the outside lines in the ▶

Motors are permanent-magnet type that require direct current. Four flashlight cells in box provide juice. Two big doorbell dry cells will give same performance, and will last longer.



drawing. Between them cement the bottom, sloping front, and crosspieces at both ends. At the rear there's a centered block to which two rounded cheeks are glued. Cement 1/16" sheet from these to the chassis sides to form rounded ends.

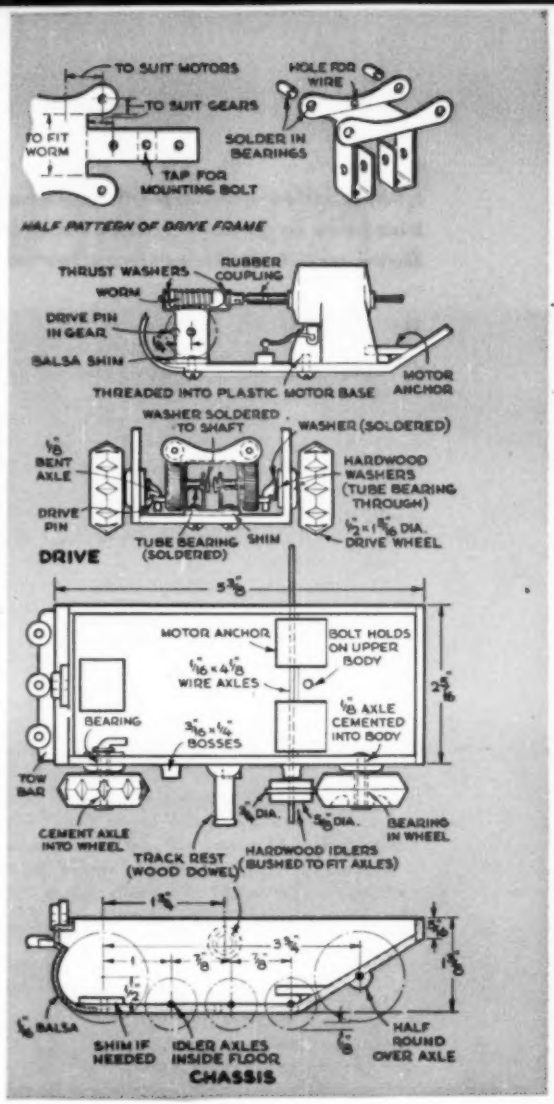
Motors can rest flat on the bottom, their bases slipped under balsa pieces cemented to the sloping floor. Two machine screws through the bottom anchor them at the rear. The gear frame may have to be shimmed up with balsa to give the gears bottom clearance and to center them with the drive wheels. If worm and motor shafts don't line up, cement shims under one or both to raise or slant them into alignment.

If you haven't a lathe, you can whittle the drive wheels from pine, mount them on a bolt, and spin in a hand or electric drill to smooth them up with sandpaper. They'll work even if not 100-percent true. Notch the rear ones for better tread grip.

Where the rear axles go through the chassis sides, cement hardwood buttons inside and out and install short bits of tubing for bearings. Bend a ⅜" leg on a piece of ⅛" rod, solder on a small washer, and insert in the bearing from inside. Cement the drive wheel on the shaft and solder on an outer washer, also cemented.

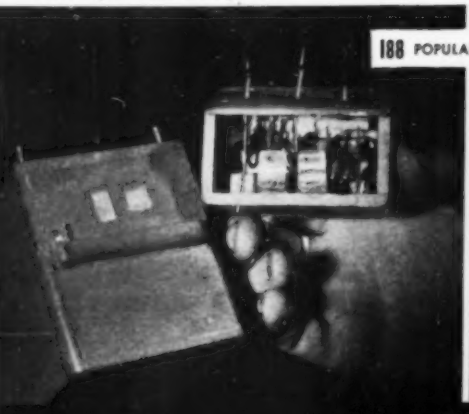
The front tread wheels are bushed with bearings and should turn freely on an axle cemented to the body with hardwood spacers between. Three idler wheels on each side run on 1/16" wire axles pushed through the chassis just above the balsa bottom. The rims of these wheels come ⅛" below the others.

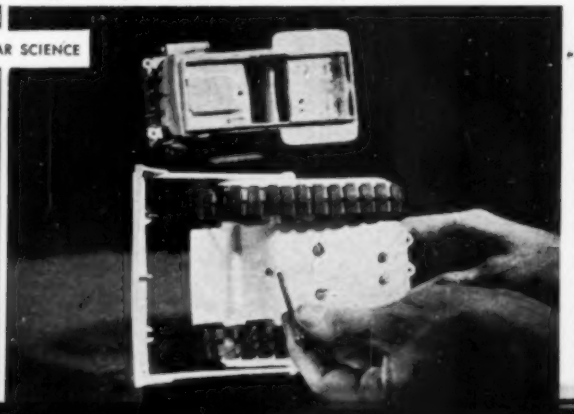
Treads. Cut two ¼" by 12" strips of inner-tube patching rubber for each tread. Remove the cloth backing and lay them ⅛"

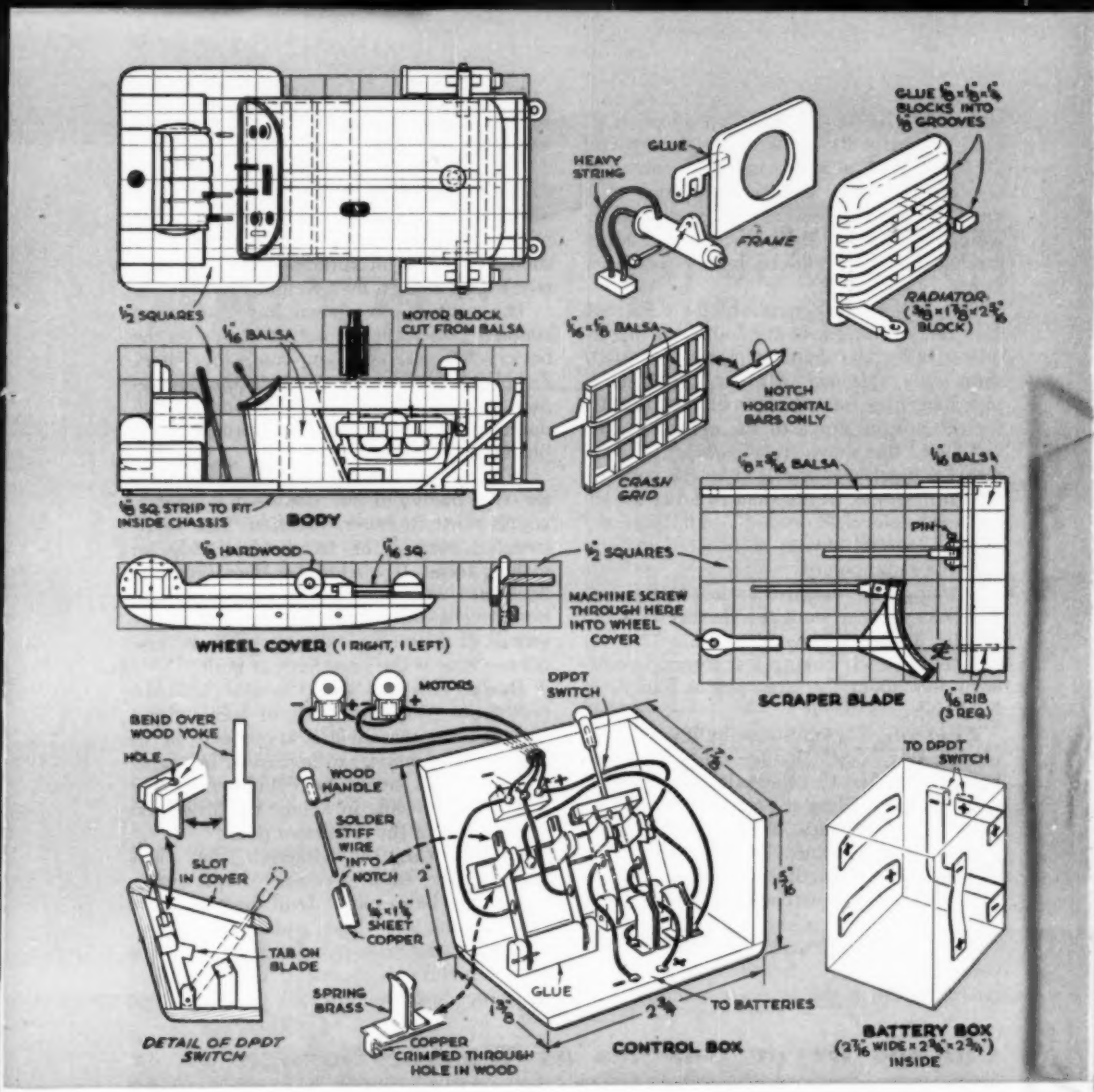


Control box is detachable from battery case. Straps on latter touch spring contacts on open back of control unit. Don't put on the handles until top of case is in place.

Long bolt through chassis floor threads into balsa motor block to hold body. Bulldozer blade pivots on bolts in wheel covers. Balsa body is easy to make and stands up well.

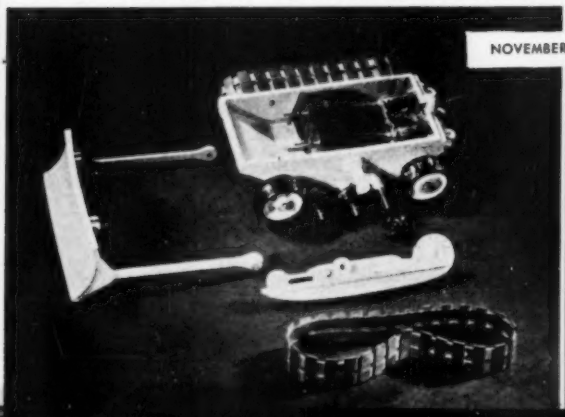






Twin motors are coupled to gear drive by rubber tubing. Clean shafts with solvent, apply cellulose cement, and slip tubing on. Upper tread rest is ¼" dowel with disk cemented on.

Four bolts grip power unit. In reversing, gear makes almost a turn before track moves, adding difficulty—and fun. For quick reverse, put two pins in gear to straddle bent wheel axle.



apart with the "live" surface up. Press on ¼" by ¾" strips of the same material crosswise ⅝" apart, flush at one edge. No cement is needed; the latex surfaces will stick at a touch if clean. To join the ends, use a slightly wider cross strip. Mount with flush edges inside. Treads should be barely snug, not tight.

Battery Box. Four flashlight cells in a case made of cigar-box wood are a handy power unit. The contacts inside are .010" shim brass, fastened with small escutcheon pins bent over outside. Cut slits in the case for the output straps to the control switch and bend the straps over outside. The internal contacts are arranged so the cells are wired in series. If you plan to label the directional control "Forward" and "Reverse," the cells should always be inserted so as to give the same polarity.

If you don't mind extra wires to the control box, you can omit the battery box and run the tractor nicely on two big (No. 6) dry cells, which having less internal resistance give about the same pep as four flashlight cells.

Controls. These also are built into a case of cigar-box wood. Glue the sides, front, and bottom together. Cut the switch blades from stiff copper, drilling the rounded end for a pivot pin that slips crosswise through a slot in a wooden block. Be sure the two pins don't touch inside. Slot the upper ends of the single-blade switches and solder in a stiff wire to mount a handle.

Three contacts, each consisting of two pieces of spring brass bent to an L shape and curved a bit at the top, are soldered to a common copper strip. Three others are separately mounted. The blades of the double-pole switch have an angled tab and are narrowed down at the upper ends. The bar is a bit of hardwood around which the narrowed blade ends are bent. All switches should be a snug fit in the pivot slots so they won't drop of their own weight.

The control box shown has two spring contacts that meet the output straps on the battery box. Instead, you can solder short, flexible wires from the straps to the double-pole switch. All blade connections are soldered directly to the blades before the pivot blocks are glued in.

Wiring. Battery output leads go right to the two blades of the double-pole switch, which controls motor direction. The single switches control the treads separately for making turns. If when wired the motors run backward with the switch in forward position, reverse the battery leads to the double switch. If the motors run oppositely, reverse connections at the one that's at fault.

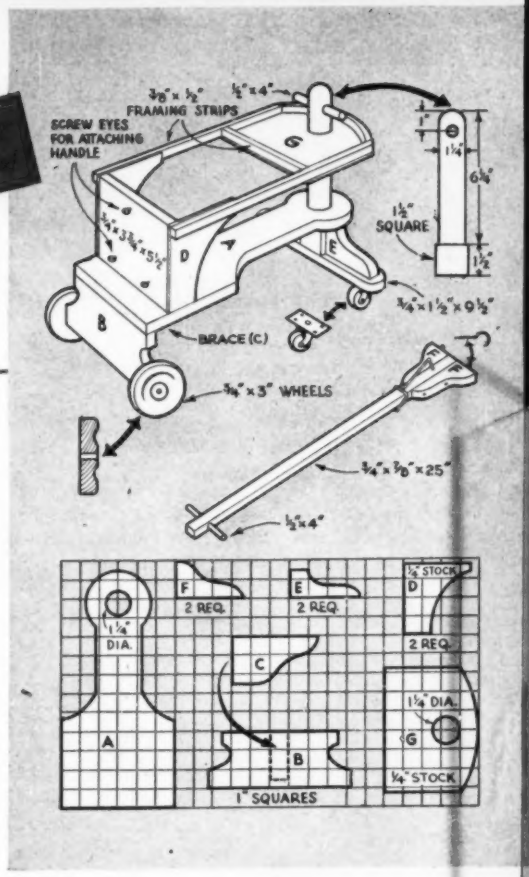
Body. This isn't scaled to any particular prototype. Make the body of balsa with a strip all around to make it fit properly on the chassis. The motor can be carved freehand. Drill out the hydraulic cylinders for the piston rods to slide in. Make the little forks on the ends of the rods from pine.

Wheel Covers. Although they look complicated, these become simple when built up of balsa parts. Drill them inside to slip over the idler axles, and cement on.

You'll find it takes some practice to put the little job through its paces. But play fair—let Junior have his turn too! END

Clothes Dryer Doubles as Washer Garage

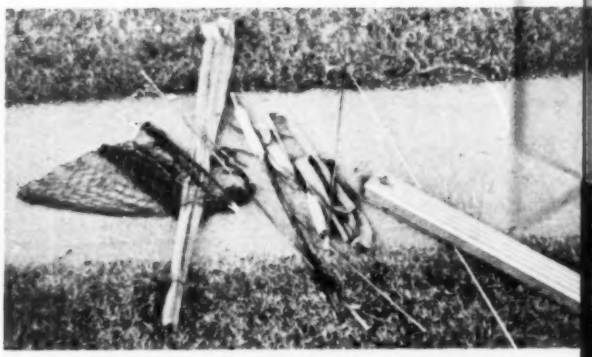
INFRARED heating units, an ultraviolet germicidal lamp, and a blower simulate outdoor drying conditions in this unit, according to the maker, The Taylor Corp., Alliance, Ohio. Between washdays, the washing machine may be rolled into the cabinet for storage. Clothes being dried are hung on wire racks that slide out of the dryer for easy loading. Priced at about $130, the dryer operates on 120-volt, 60-cycle current. It draws 1,280 watts per hour. A timer switch automatically shuts down the unit.



Stroller Carries Her Doll

LITTLE girls, like their mothers, can be pretty persistent when they want something. Judy, my seven-year-old daughter, wanted a baby walker for her dolls. And it had to be just like the ones she saw mothers wheeling along the sidewalks. She persisted, I gave in, and here's the doll walker—a Christmas toy that's a little different.

Patterns can be scaled off the squares at right. Part C is a brace that helps hold A and B together. Ordinary furniture casters serve as the front wheels. The rear wheels can be cut out on a bandsaw or jigsaw. Use 2¼" roundheaded screws to fasten the rear wheels in place. I gave the walker a two-tone enamel finish, applying two coats to all parts.—*Ralph S. Wilkes, Keuka Park, N.Y.*

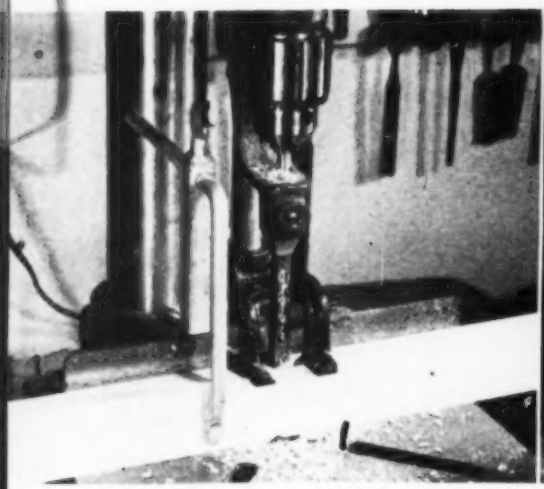


Rod Case Built of Downspout

A SECTION of aluminum downspout makes an attractive and serviceable carrying case for all the fishing equipment shown in the photo. Close one end of the spout with a hardwood plug. Drive roundheaded brads through the aluminum and into the wood. If you want a watertight closing, bind tape around the end and finish with a couple of coats of waterproof varnish or shellac.

You can cap the other end with sheet metal, hinging it to the case. Or you can rivet a piece of scrap leather to the case as I did. As a final touch, you can add a regular luggage handle with two short straps. These may be shifted on the case for proper balance.—*Burnam Harmer, Seattle, Wash.*

mixer, including all its accessories, is remoded up in one unit.



Front of frame is assembled with mortise-and-tenon joints. Shown above is the setup for cutting the frame mortises on the drill press.

Before assembling, drill tiny hole through frame into each mortise to let air and excess glue escape when tenons are inserted.

It's Easy to Use Our Mixer Now

By Roland Cuera

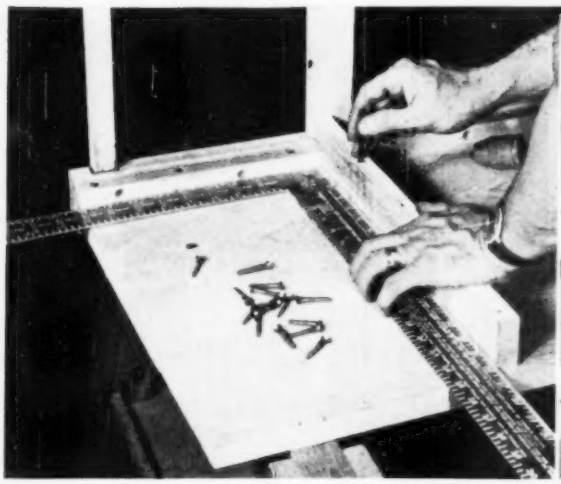
JUST getting ready to use the electric mixer was a big production at our house. The routine went like this: Clear space for it on kitchen table. Locate mixer and accessories, usually piece by piece in six different cupboards. Set up mixer. Then discover mixer cord won't reach outlet. Clear new space. Move everything again.

Building this cabinet put an end to that nonsense. Now the mixer and everything connected with it are compactly housed, ready for convenient use. Sitting in a recess on the top, the mixer is flanked by two drawers for small spice containers or recipes. Just beneath the top is a sliding board for rolling dough or for chopping foods. Next is a large compartmented drawer. This takes a rolling pin, mixing bowls, and other accessories. At the bottom are two tilt-out bins for sugar and flour.

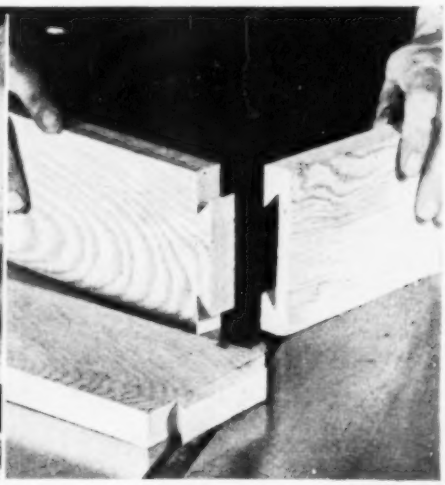
First step is to cut out the ¾" stock for the sides and top. These are in two pieces, splined or doweled and glued. In making the frame, leave about a 3/16" shoulder around all tenons. Use glue in all joints. Construction details of the base are shown in the drawing. Fasten the backpiece in the notches with glue and screws. Round off all corners and edges.

Now assemble the sides—but not the top—to the frames. Sides are screwed first to the ¾" framing pieces. Then the framing pieces are screwed to the front of the frame from the inside. After the plywood bottom is screwed in place, screw the cabinet to the base.

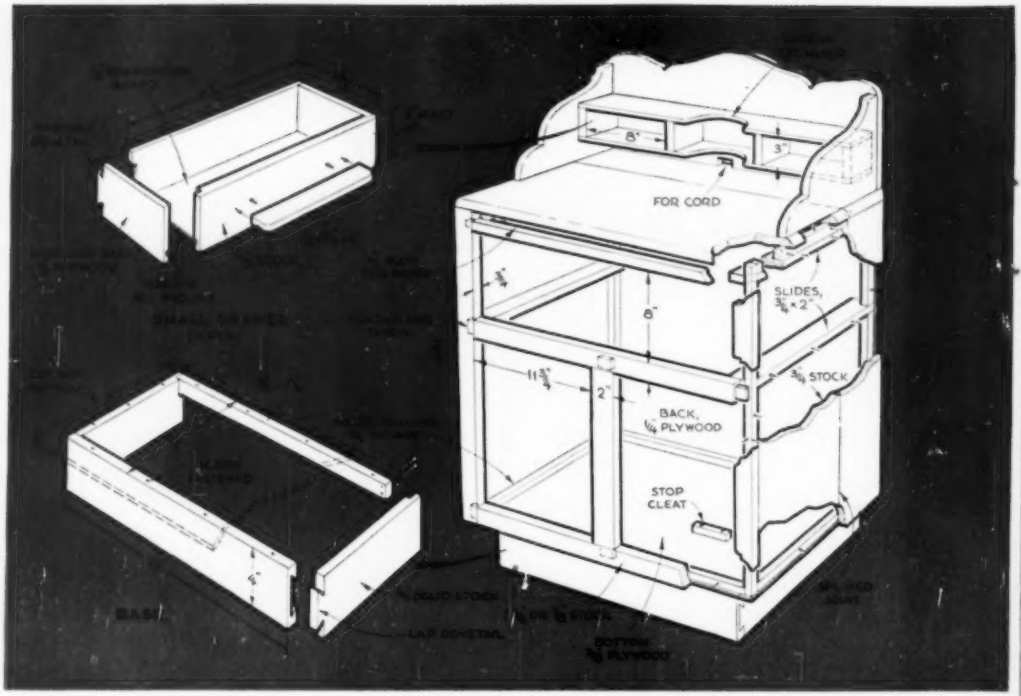
Cut out the ¾" upper backboard and sidepieces with a bandsaw or jigsaw. Screws driven from under the top will fasten these parts. Assemble the small-



Drawer slides are screwed to sides of the cabinet. Here, a slide is squared up carefully before it is attached with countersunk screws.

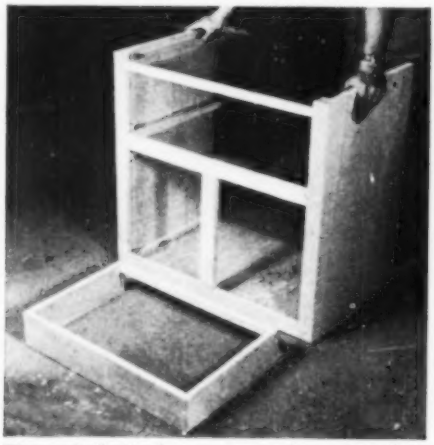


Front and sides of base are assembled with lap-dovetail joints. Rear of base is screwed into notches cut in the base sidepieces.

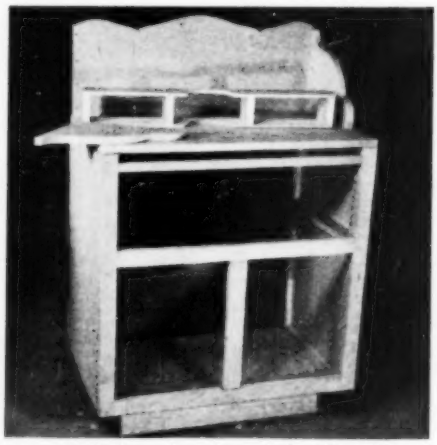


drawer tier and glue and brad it to the sides and back. Attach the top assembly to the cabinet with the cleats just above the work-board slides.

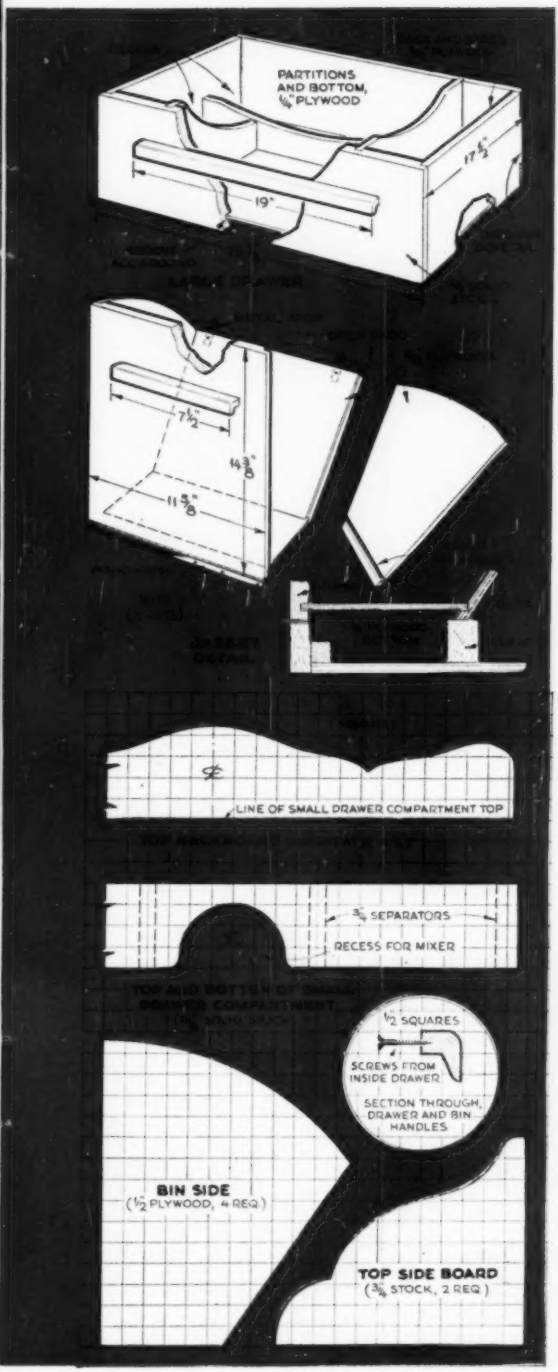
Drawers and bins are standard construction. The dovetail joints at the backs of the drawers need only glue. Handles can be cut as indicated on the squares, or you can buy wooden or metal ones. I finished the cabinet with enamel. END

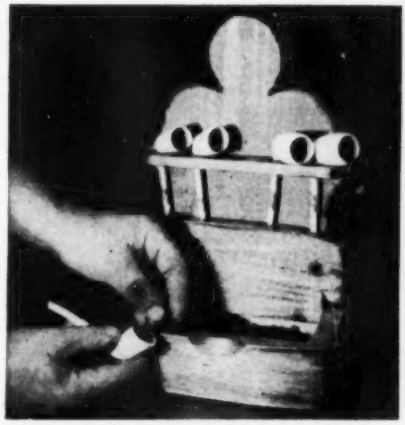


Plywood back has not yet been installed. Framework, with sides attached, is ready to be screwed down onto the base.



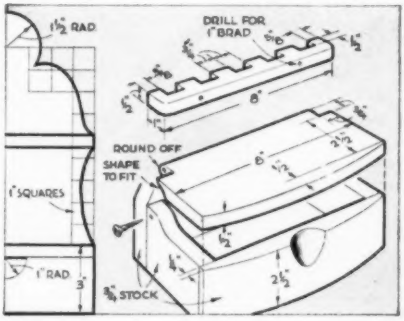
Top, including bandsawed backboard and sides, is attached by screws from underneath after small-drawer tier is screwed in place.





Tobacco Box Holds Pipes

A COLONIAL spoon rack and salt box are combined in the design of this pipe holder and humidor. Cut the back from ¾" pine and the pipe rack from ½" stock. Glue and brad the rack to the back. The ¾" sides are 3" wide. Curve them from 3" high at the back to 2½" high at the front. Plane and sand the ¾" by 2½" by 8" front from a full thickness at the center to ¼" at each end. Glue and brad the sides, front, and bottom together. Cut the ½" lid to fit exactly over the box. Notch the two rear corners to fit as shown. Clamp the lid in place and drill for the screws that act as hinges. Brad the box to the back and finish with shellac and paste wax.—*Norbert Engels, South Bend, Ind.*



Two Marble Games To Play Indoors

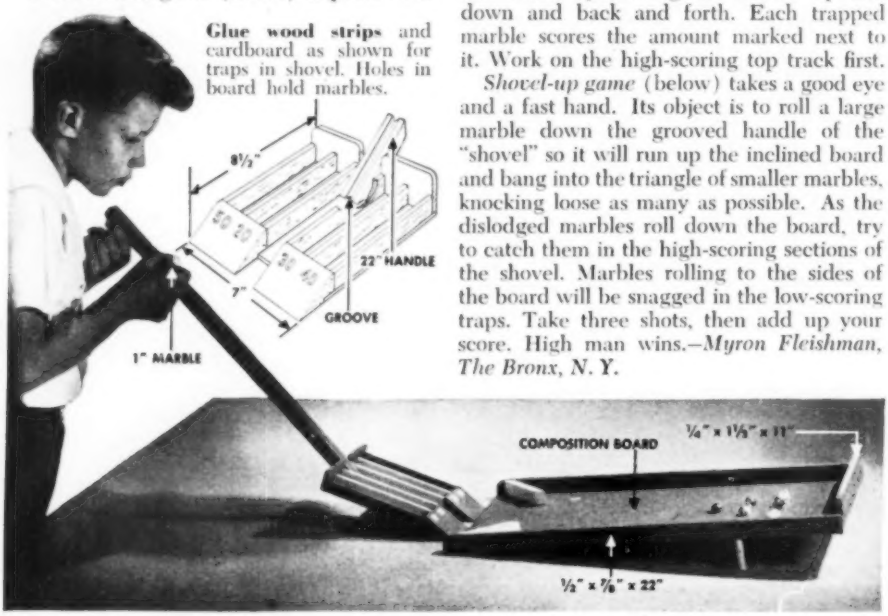
Make it Now for Christmas

Shallow dips, 4 in upper track and 6 in lower, catch marbles. Groove midway in each track holds marbles until start of game.

YOU can make either of these marble games in an evening—and they'll keep the kids out of mischief on stormy days. The photos above and below show you their dimensions, and here's how each is played:

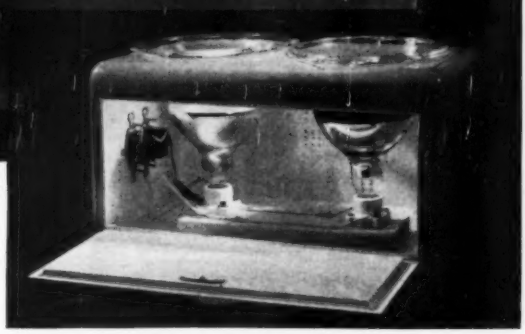
Double-deck game (above) requires both skill and speed. Start by placing four marbles in the top track and six in the bottom. Set a time limit to speed up the fun. Then remove the leveling block and try to roll as many marbles as you can into the shallow dips in the tracks by moving the handle up and down and back and forth. Each trapped marble scores the amount marked next to it. Work on the high-scoring top track first.

Shovel-up game (below) takes a good eye and a fast hand. Its object is to roll a large marble down the grooved handle of the "shovel" so it will run up the inclined board and bang into the triangle of smaller marbles, knocking loose as many as possible. As the dislodged marbles roll down the board, try to catch them in the high-scoring sections of the shovel. Marbles rolling to the sides of the board will be snagged in the low-scoring traps. Take three shots, then add up your score. High man wins.—*Myron Fleishman, The Bronx, N. Y.*



Glue wood strips and cardboard as shown for traps in shovel. Holes in board hold marbles.

Cooking with both burners. Two portions of bacon fry to a crisp brown.

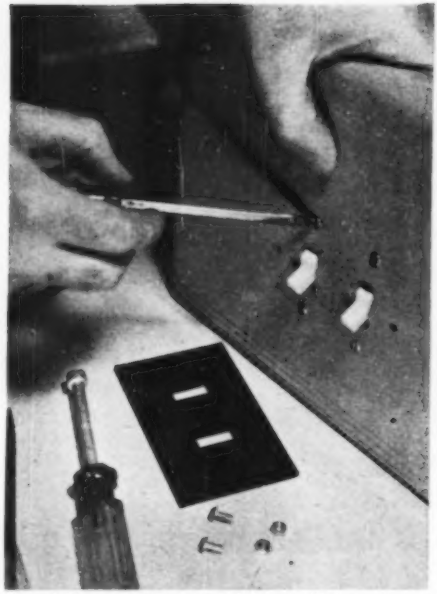


Breadbox Stove Cooks with Infrared Rays

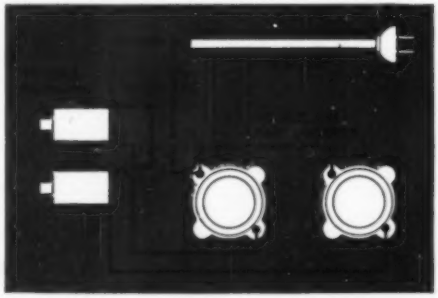
FOR a leisurely Sunday breakfast or a late snack, your wife can park this stove right on the dining table. It's easy to make—a splendid Christmas gift—and next summer, she'll appreciate the little stove's coolness. A regular stove puts out lots of wasted heat—heat that just warms the room. The infrared stove heats only what the rays are aimed at and

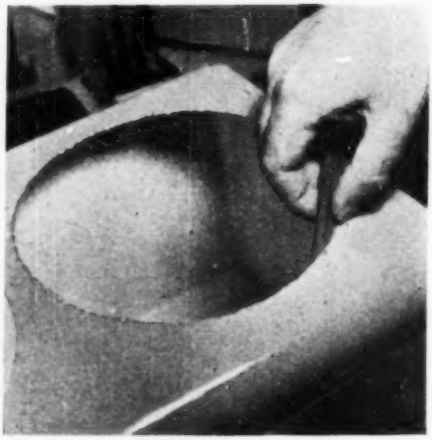
Cooking with heat rays is a little different. Here are a few tips.

EGGS	Can be fried or scrambled. When fried, whites are soft—similar to a poached egg. Use a little butter or shortening in the glass skillet.	CANNED FOODS	Are quickly heated. There's never any danger of the food boiling over. If it stays over the heat too long, it will only simmer.
FROZEN VEGETABLES	Should be thawed to reduce cooking time. Use minimum of water and stir frequently for better heat distribution and quicker cooking.	POTATOES	Can't be baked but can be creamed, fried, boiled, or scalloped. In boiling, rays heat potatoes, which heat water that holds right temperature.
SOUPS (Prepared)	Clear ones—like consomme—take longer to heat. Dark soups—pea or tomato—absorb heat rays faster and are ready to serve sooner.	MEATS	Can be fried. Thickness of meat determines cooking time. Bacon fries to rich, golden brown—never burns and doesn't splatter grease.



Two light switches, wired in parallel as shown below, control the infrared lamps individually.



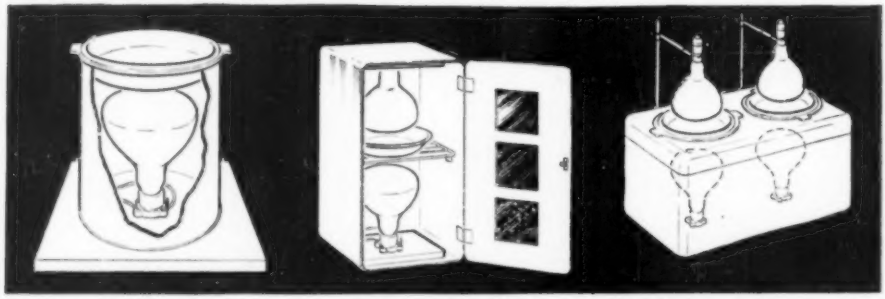


Hacksaw two circles in top of breadbox to fit Pyrex dishes. Use file to smooth metal edges.

penetrate. The gentle cooking action of the rays doesn't splatter grease the way frying on a gas or electric stove does. And, with a power drain of only 500 watts for both bulbs, the cooker draws far less juice than a toaster, iron, or electric hot plate.

Use clear Pyrex® utensils. Aluminum, enamelware, or any other opaque pot will only block the rays and you won't do any cooking. You'll notice, too, that darker-colored foods cook faster than light ones. Dark colors absorb the heat rays better. I use two Pyrex dishes over each bulb. The bottom one stays permanently in place and the top one is used for cooking and serving.

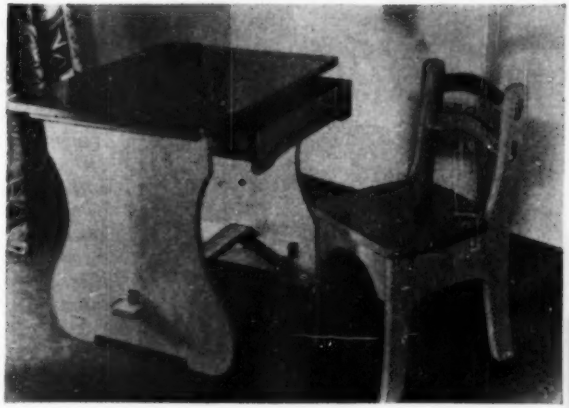
The infrared bulbs with red filters cost more than the clear ones, but the filter cuts down the glare. That's the only difference. *—Arthur Miller, Manhattan, N. Y.*



One-burner job can be quickly made with kitchen canister or a large tin can. Mount socket on square of wood.

For faster cooking of meats, mount infrared lamps like this. Openings in breadbox door have red plastic windows.

Here's a two-burner stove with four bulbs. This gets heat on two sides of food for faster cooking.

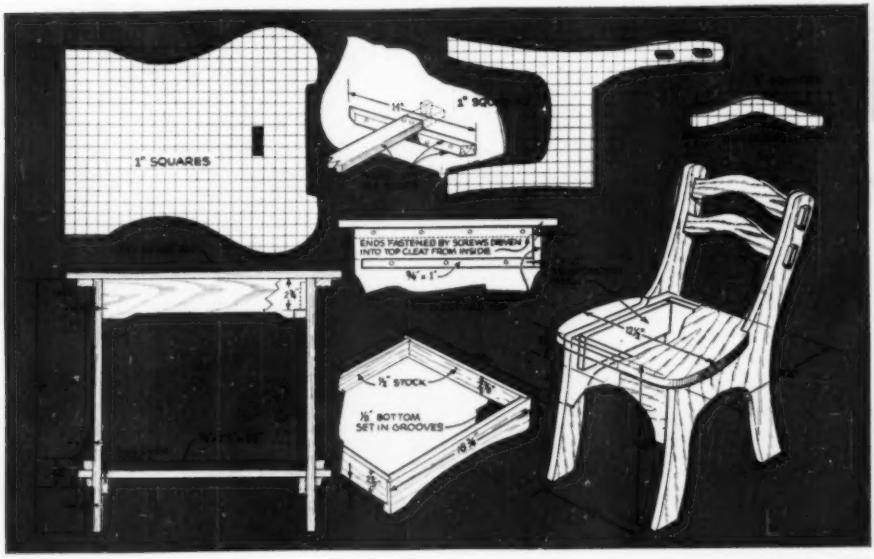


Every Child Needs a Desk

YOUR youngsters will get as much fun out of using this desk as you will making it.

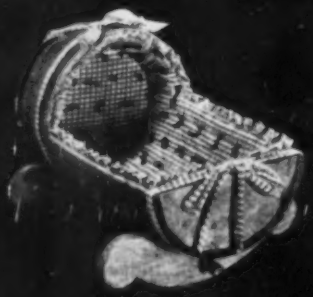
I used doweled and edge-glued ¾″ pine, though you may prefer the greater simplicity of plywood. Use a bandsaw or jigsaw to cut out the two desk sides and a circular saw to cut the rectangular top. Add two cleats to the latter and one to each side, and bore and chisel out the square-ended slots for the footrest. Assemble the sides and top with glue and screws driven into the cleats. Close off the back of the drawer space with an apron 4″ wide, cut to the same shape as the drawer front. The drawer itself is of conventional construction and has a bottom of ⅛″ hard composition board set in grooves in the drawer frame.

If you make the chair of edge-glued stock, be sure to lay it out so that the grain is roughly parallel to the legs and back. Before assembly, cut slots that are a snug fit for the ½″ back slats. The two chair aprons are identical. Assemble with glue and screws, concealing conspicuously located screws with plugs if you plan to use a natural finish. Use a block plane to cut chamfers on all exposed edges, and sand thoroughly with medium and then fine paper. I finished my pieces with three coats of clear lacquer.—*C. E. Sorenson, Burbank, Calif.*



Make it Now for Christmas

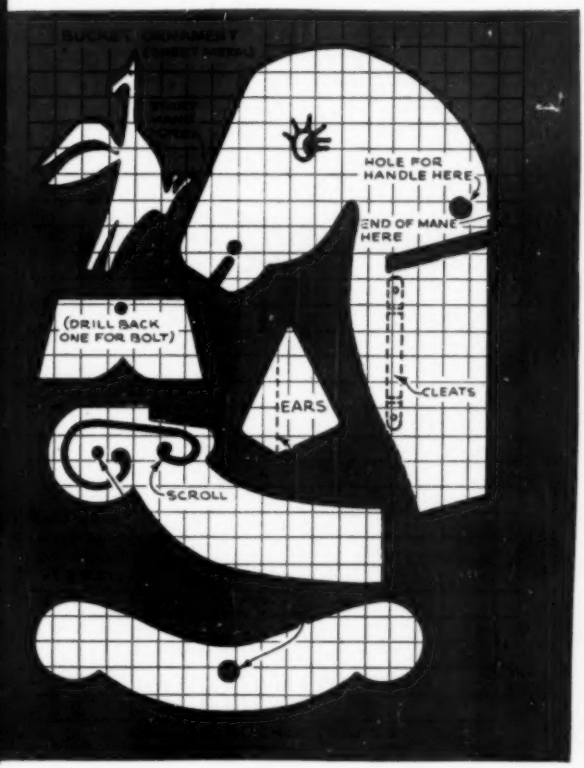
Keg Toys Are a Barrel of Fun



IF YOUR toy problems have you over a barrel, that barrel may be just what you need. This spirited pony, doll cradle, and toy bucket all started out as old nail kegs.

To make the rocking horse, cut the head, rockers, and spreaders from 1″ lumber—"packing-case pine" will do—according to the patterns shown. Drill ½″ holes in the rockers at the proper angle and assemble the unit by placing the spreaders at the ends of the keg and tightening 8″ carriage bolts run through the rockers. Screw the keg onto the spreaders from the inside and run a bolt through the barrel and the back spreader. While the keg is still open, drill a hole through the back end for the rope tail, knotted and nailed from the inside to hold it in place. Also secure a chunk of 4″ by 4″ waste inside to balance the head.

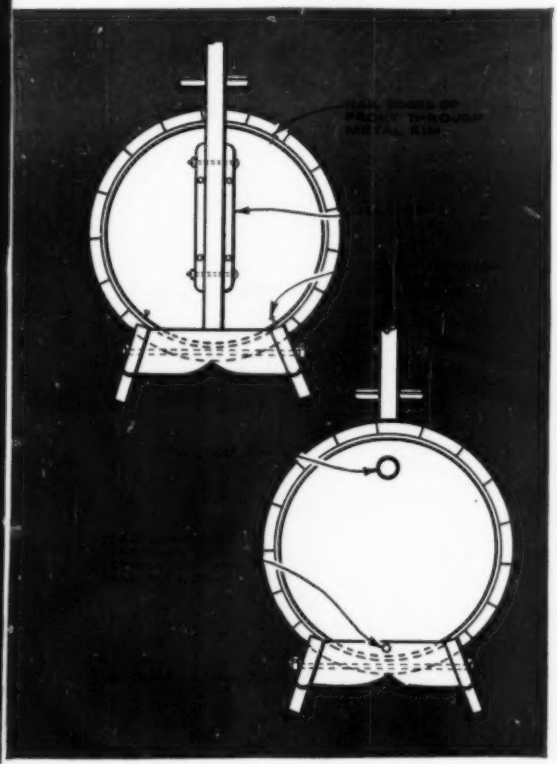
Screw cleats to both sides of the neck and then screw through these to the half-circles fitted to the front of the keg. Slip the slot in the neck over the edge of the keg and nail the unit in place through the holes in the metal binding.



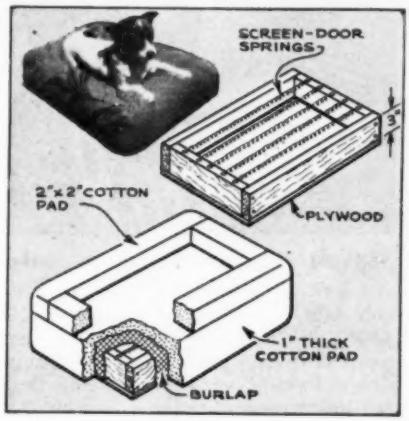
Make the mane by winding loops or knots of short, raveled strands of rope over heavy twine and stapling it along the profile of the head. Ears are cut from soft leather and tacked in place. Eyes, nostrils, and scrolls on the rockers are painted on. The gay saddle blanket is striped canvas tacked down with upholstery tacks.

The cradle is a simpler project. Cut away half of the staves a few inches from the bottom end. A half-circle must be cut to fill the open end of the keg, forming the cradle foot. Cut out the rockers and drill them for a ½" dowel to run lengthwise. Fasten on the cradle with screws from inside the keg. Pad the inside of the cradle with bright checked gingham or chintz. Bows of the same material cover the wire around the keg and the nails at the foot of the cradle.

Easiest of all is the toy bucket. Staves are cut away except for two, which are drilled near the top for the broomstick handle to fit across them. It may be painted or decorated with metal designs tacked on as shown.—*Doris Aller, San Francisco, Calif.*



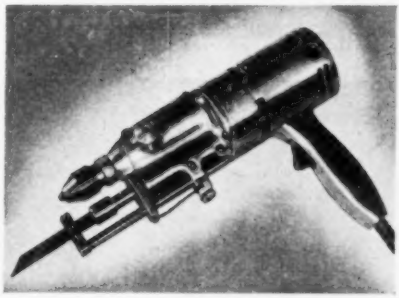
Who Said a Dog's Life?



THE BEST way to keep your dog off the furniture is to give him a bed of his own. This one's de luxe—with springs and even the hollow a dog likes to make.

Stretch screen-door springs across a box frame, as shown above, and cover them with burlap and a cotton pad. Build up the sides with 2" by 2" strips of cotton padding. Then tack material over the top, leaving it a little slack so it will sink into the hollow when the dog lies down.

New Tool Is Jack-Of-All-Jobs



THIS new, all-purpose, portable electric tool gives you a choice of either rotary or reciprocating action at the touch of a control. Without attachments it can do such jobs as sawing, drilling, filing, honing, sanding, embossing, and burring. It can be used in a horizontal stand as a bench grinder or in a vertical stand as a drill press or jigsaw. It takes a ¼" drill; a 3/32"-thick hacksaw blade. Weighing 6 lb. 8 oz., it is made by Sheldon Products, of Cleveland, to retail at $79.50.

Match Flame Softens Solder

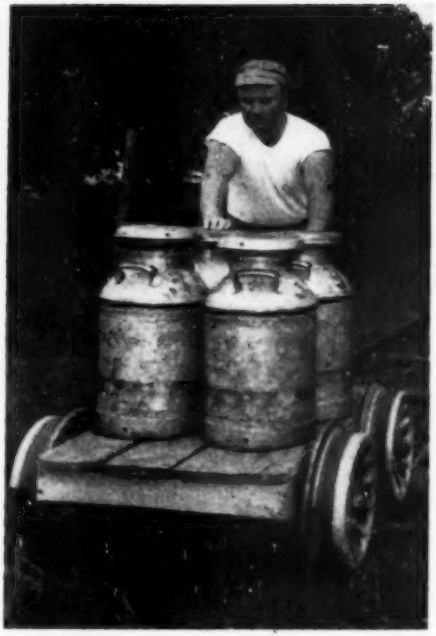
A NEW solder offered by the Proved Products Mfg. Co., San Fernando, Calif., has such a low melting point that you can do small jobs with a match flame. It's made in ribbon form ¾" wide and contains flux. A 30" length costs 25 cents.

Beam Bender Ends TV Spot

THE bright white spot you see when you turn off your TV set may cause a burnt spot on the tube face. A new magnetic yoke made by Clarostat Mfg. Co., Dover, N. H., bends the fading beam to keep the bright spot out of the picture area.

Adapter Plays All Records

THE adapter above will enable you to play records of all speeds—33⅓, 45, and 78 r.p.m.—on your present phonograph. Made by Carbonneau Industries, Grand Rapids, Mich., it slips over the spindle. Small drive wheels vary the speed ratio.



Railroad Creeper Hauls Milk

TO MOVE milk cans from his barn to the pickup point at the highway, Paul Malyk, of Williamsfield, Ohio, adapted a railroad creeper to run on 1" pipe spiked to railroad ties. He feels the pipe track is better than regulation rails because the wheels easily cut off all snow and ice in winter.

Foot Scraper Has Hand Rail

ORDINARILY you must go into a stork act while using a foot scraper to clean mud or snow from your shoes. You stand first on one leg, then on the other, and there's always the chance of a fall.

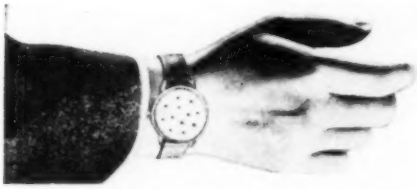
The scraper shown gives you something to hang onto. This consists of a length of ½" pipe bent to a U shape and welded to the metal on either side of the scraper. Make the loop waist high so you can grasp it easily.—*Elton Sterrett, Houston, Tex.*

Sight Sees Big or Small

MAYBE this gun sight can't make a mouse look like a moose—but it comes close. A twirl of the knurled ring the hunter is fingering instantly changes magnification from ½X to 4½X. The telescopic sight can be used with any number of rifles since it slips into a special mount made to fit most popular big game guns. Bausch & Lomb, the maker, claims that it is the first variable-power telescopic rifle sight made in this country.

Glue Spread by Old Squeegee

WHEN you're gluing up wood, especially large, flat pieces, a small window-cleaning squeegee provides an excellent means of spreading the glue in a thin, even coat over the wood.—*Herbert R. Pfister, The Bronx, N.Y.*



"Ears" to Wear on Wrist

A LONG way from the old-fashioned ear trumpet, this new hearing-aid microphone attracts no more attention than a wrist watch. And the Acousticon Wrist-Ear® is not only inconspicuous, but can pick up conversation behind the user. It is also convenient in making phone calls. Another microphone is disguised as a tieclasp. For women, there is a choice of attractive brooches. All the pick-up devices are used in conjunction with standard Acousticon hearing-aid amplifiers.

The Height of Ingenuity

We were stuck for water when workmen shut off the supply at the main. Instead of toting pails of water from a neighbor's house, I rigged up a system that put plenty of running water in our home. How?

I hooked one end of our garden hose to a faucet. Then I changed the connection on the other end of the hose so my neighbor's hose would fit it. When his hose was screwed to his faucet and the water turned on, the water flowed through the hoses and into the pipes in our house.—Leon L. Walters, Chicago.

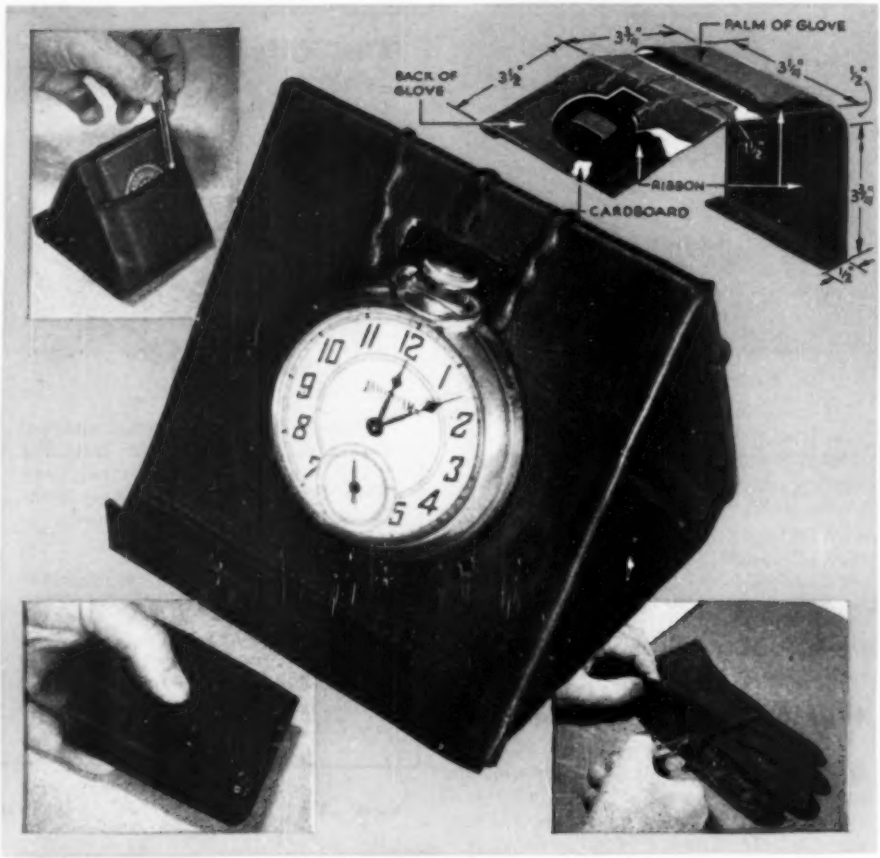
New TV Tube Is 7" Shorter

BIG cathode-ray tubes for television receivers have always required deep cabinets to accommodate their length. A new 19" tube introduced by Du Mont Laboratories will fit into a much shallower cabinet. Only 21½" long, this tube is about 7" shorter than the old Du Mont tube of similar size.

Strap Stops Rattling Windows

THIN metal strapping of the type used on crates can be adapted to prevent house windows from rattling. Cut a straight strip about 18" long. Double over one end for 1½" and drill or punch this section for two small flathead screws. Bend the rest of the length in a slightly wavy form, making each bend about 3" from the other.

Make four of these for each window. Install one in the channel on either side of each sash. For the lower sash, fasten them as high as possible; for the upper, as low as possible.—*John E. Baker, Paterson, N.J.*



Glove Turns Watch Into Traveling Clock

Make it Now for Christmas

YOU can turn a glove and an inexpensive pocket watch into a good-looking traveling clock. Folded in its leather case, it will pack safely into a briefcase or overnight bag, and even stay-at-homes will find it both handy and handsome on a night table or desk. A small pocket on the back holds pencil and notebook for phone numbers or midnight memoranda.

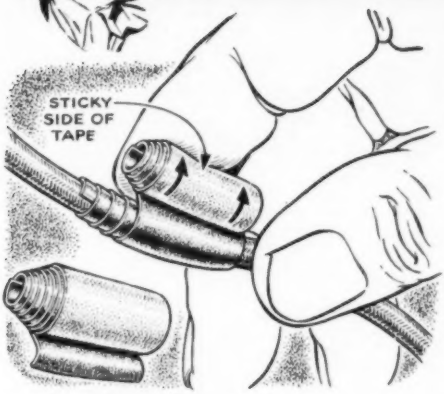
First step is to cut out a 3¼" by 12" stiffener from a piece of stiff cardboard. Score fold lines and bend the card as shown. In the bottom section cut an opening the same size as the watch.

Now cut the glove. From the back snip out a piece 4" by 5". Paste it to the cardboard with cellulose cement and cut an opening for the watch.

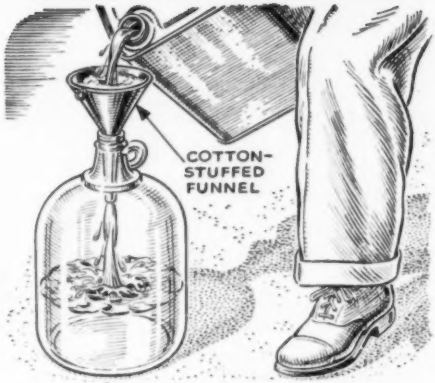
For back and lining, buy a yard of matching 4" ribbon. Fold under both edges to make it 3¼" wide and cement it to the back of the cardboard around the end and up along the top side. The glove palm makes a pocket for an address book. Cut it 2½" by 4"; apply cement only to the bottom edge and the overlapping sides.

As a support for the watch, fold a strip of adhesive tape sticky side out, fasten it to the ribbon at the center of the cutout, and press the watch down over it.

Hints from the Model Garage

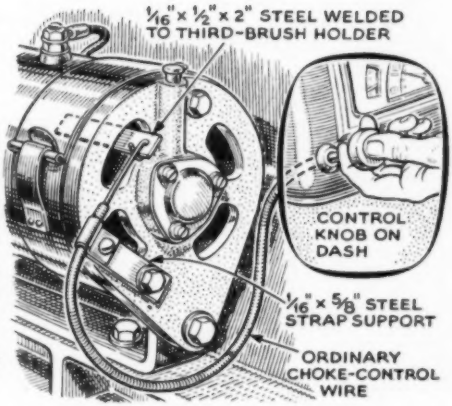


Look, One Hand! In a spot where there's barely space for one hand, how can you tape a wire? Simple enough, says Harry Morse, Oakland, Calif. Tear off a piece, re-roll with the sticky side out, and wind on with the fingers of one hand.



Filter Your Antifreeze. Before putting stored antifreeze back into your car, it's a good idea to filter it through a wad of absorbent cotton placed in a big funnel. You'll find a surprising amount of last year's dirt on the cotton.

Clearing Fogged Windows. Richard H. Hanson, of Melrose, Mass., makes it a practice to carry an extra windshield-wiper blade. Besides serving as a spare in case of loss of one of the regular blades, it also comes in handy as a squeegee for clearing fogged windows. It's also useful for drying the windows after a car wash.

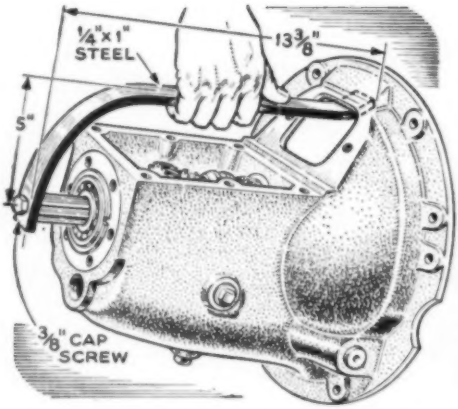


Varies Generator Output. This control enables Rowlins Howard, Rushville, Ind., to vary the generator output on his 1934 Chevrolet to suit conditions. On short hops and at night, he pulls the knob and gets readings of 15 or 20 amp. On a long trip he cuts output back to 4 or 5. This helps prevent battery overcharging.

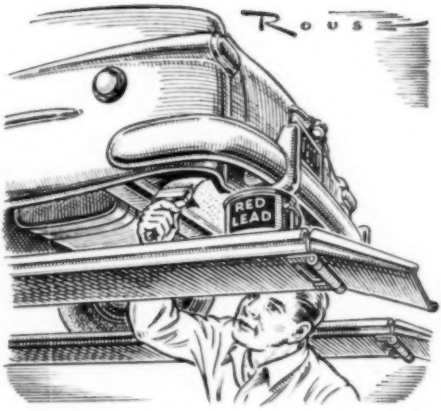
Turn Page for Three More Hints

MORE Hints from the Model Garage

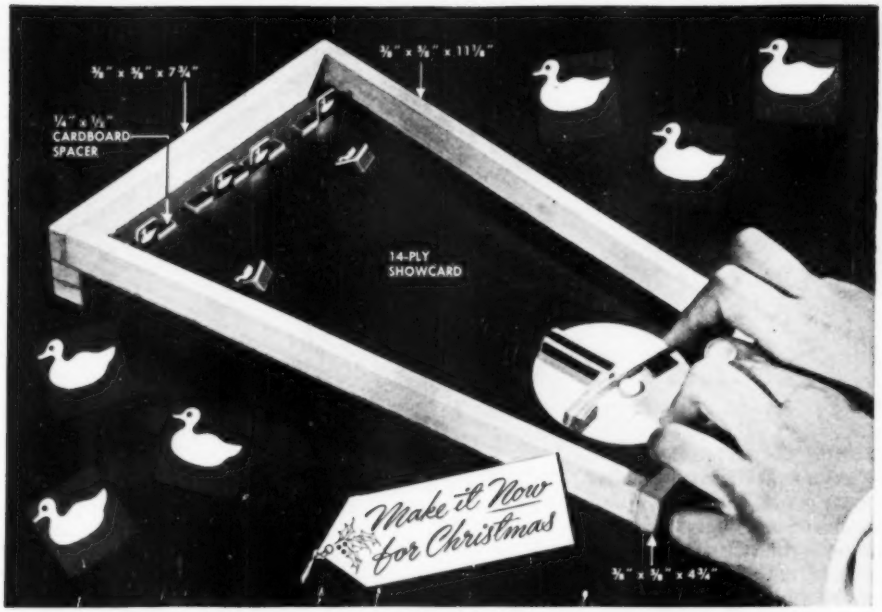
Door Mirror Widens View. If there are children in the neighborhood, backing out of a driveway is always a risky business. A mirror mounted on the driver's door as above will help cut down any blind spot behind the car. Locate it as near as possible to the outer edge of the door to get a wide angle of vision.



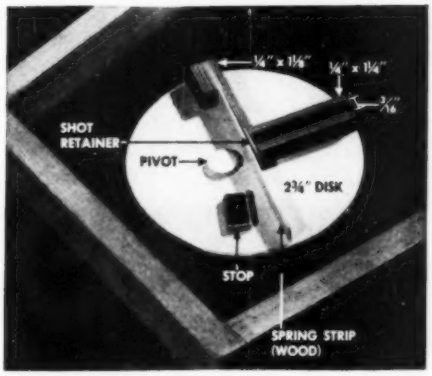
Transmission Lifter. Back in the days when Fords had the shift lever on the floor, the lever could be used to lift the transmission out of the car. But on later models there's practically nothing to which you can hold. To ease the job, mechanic William E. Ware, of Shirley, Ind., made the lifter shown here.



Red Lead Stops Rust. If you don't want to spend the money for a regular undercoating job, you may want to try red lead. You won't get any sound deadening, but at least you can protect the fenders and other metal from rust. A. Bogossian, Brooklyn, N. Y., reports he finds absolutely no rust two years after doing his car.



Ducks to Shoot On a Table Top



NO "MERE BAGATELLE," this is a real game of skill. You play by taking careful directional aim and then snapping a thin wood strip to hurl a lead shot at the ducks.

To make the board: Use heavy cardboard for the bottom, shaped as shown above. Wood strips frame the sides and raise the target end. Cut out six ducks on ½" x ½" cardboard squares and attach to ½" x ¼" wood bases. Glue seven spacer strips to the board so targets fit loosely between them.

To make the shooter: A cardboard disk, pivoted on a thumb tack, forms the base, as at left. Two cardboard strips glued upright guide the shot. Across the rear end, a thin strip holds the shot, but a small hole lets it protrude enough so the wood snapper can get a good swat. The snapper's fixed end is mounted in cardboard, glued to the disk.—*Frank Shore, Manhattan, N. Y.*

A "Quickie" for the Baby

A CIGAR box and two wooden coat hangers are all you need to make a cradle for your daughter's doll. Simply remove the lid from the box and the wire hooks from the hangers. Then fasten the box onto the hangers with wire brads and glue, as shown at right. For a more solid job, you can mount the hangers flat against the sides of the box.

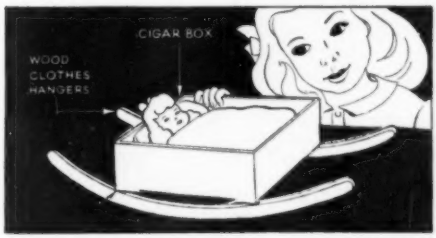


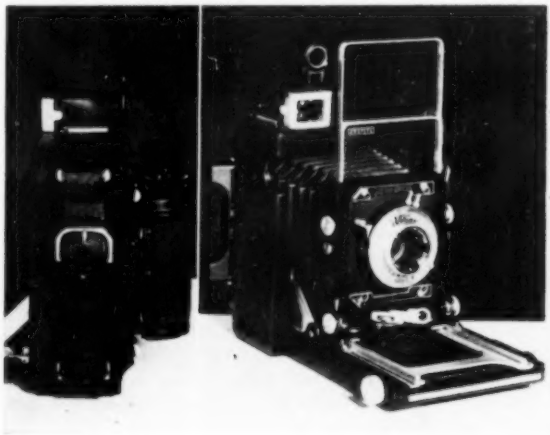
PHOTO IDEAS AND EQUIPMENT

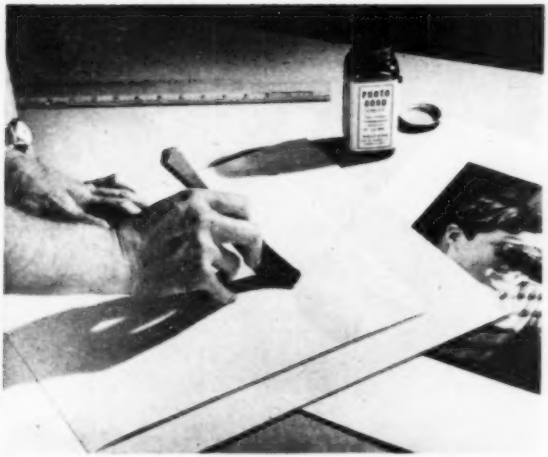
Tissue Diffuses Print. A piece of tissue paper, cut to fit on the top condenser of a condenser enlarger, will produce a soft print, more flattering to the subject in the case of portraits. Because the tissue holds back some of the light, it will be necessary to increase exposure time.—*Virginia Hanson, Santa Monica, Calif.*

Meter for Land Camera. A matchbox-size exposure meter for use with the print-a-minute Polaroid Land Camera (PS, Feb. '49, p. 232) is being produced by General Electric. It is calibrated in numbers from 1 to 8 to correspond to the aperture settings on the camera. Film speeds are set by rotating the dial.

Stills from Movies. This new Federal enlarging camera (below) lets you make stills from movies without cutting the film. Just pull it through a slot to the frame you want, then push a button to print it as a negative on 127 roll film. A magnifying viewer enlarges the movie film to aid selection. The exposure light is built in. Made in two models, for 8-mm. and 16-mm. film, the unit sells for about $20.

New Graphic Is Versatile. This new 2¼ by 3¼ Century Graphic, for around $110, embodies many of the features of the more expensive Crown model. It's equipped with a Graflex Trioptar f/4.5 coated lens in a Century synchronized shutter with speeds from 1/10 to 1/200 sec. It will take cut film and film packs. A special holder, shown at left below, that adapts it for roll film is available for $20 extra.





Liquid Mounts Photos. Most glues or cements are unsafe to use on photos because they may cause the print to discolor. A new solution made with Vinylite® resins by Photo Bond, Akron, Ohio, is said to overcome most of the problems usually encountered in cementing down prints in albums or on mounts. An 8-oz. bottle costs 65 cents.

Glass Makes Table Top. I have found that one of the best surfaces for photographic work is a sheet of tempered plate glass called Herculite®. Used as a table top, as below, it's easily cleaned and lets you see needed items in the drawer below it. In the ¼" thickness, it supports considerable weight and withstands heavy blows. It can be ordered with polished edges.—*John P. Arnold, Doylestown, Pa.*

MECHANICS OF LIVING

Backstage in a TV Tube

OLD sailors who build ship models inside of bottles have nothing on electrons. These busy particles put on a whole picture show inside a sealed glass bulb. What happens and why are shown on the next two pages.

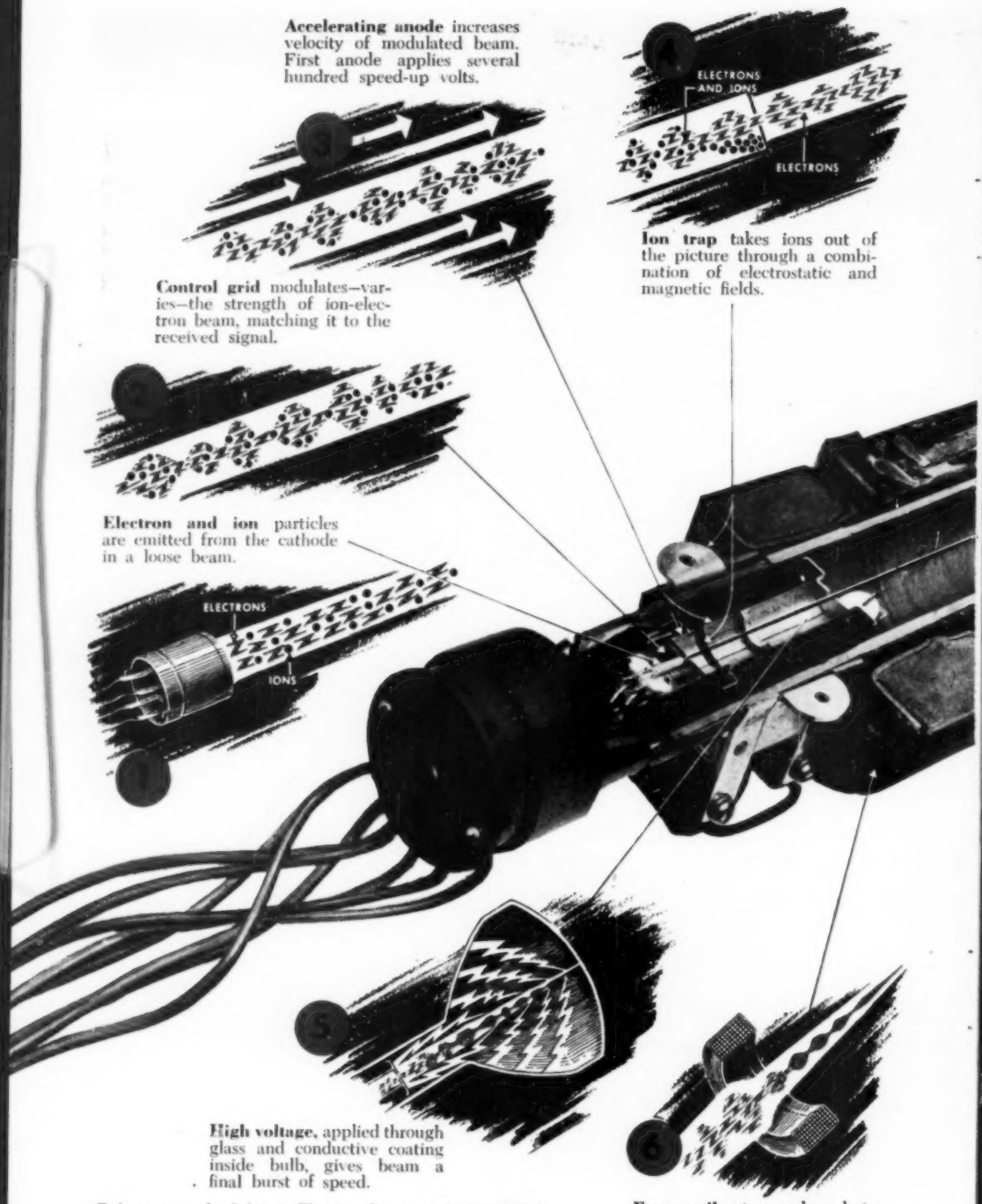
Most of the tubes and circuits in your TV receiver pipe "information" into the neck of the picture tube. This information arrives as many different kinds of voltages. Their job is constantly to alter a high-speed electron beam so that it paints a series of pictures on the phosphor-coated glass at the tube's end.

The electrons in the beam are pushed out from an oxide-tipped cathode by an electrically heated filament. However, a stream of ions is also pushed out. Both ions and electrons are negatively charged particles, but ions are about 2,000 times heavier. If they should hit the screen, they would chip the phosphor. To deflect the ions into a dead end, the tube we're studying uses a team of electrostatic and magnetic fields.

To make a bright picture, the electrons must move fast and hit the fluorescent screen hard. To pick up this speed, they are passed through successively higher voltage fields, getting a kick from each.

Magnetic coils focus the beam to pinpoint sharpness and bend it both up and down and from side to side. This is the vital step since the picture you see is put together in tiny pieces. Present standards call for 525 interlaced lines, each one changing 30 times a second. Actually there are fewer lines since time is lost when the beam jumps back from the end of one line to the beginning of the next.

For an inside view of a TV tube, turn the page.



Accelerating anode increases velocity of modulated beam. First anode applies several hundred speed-up volts.

Ion trap takes ions out of the picture through a combination of electrostatic and magnetic fields.

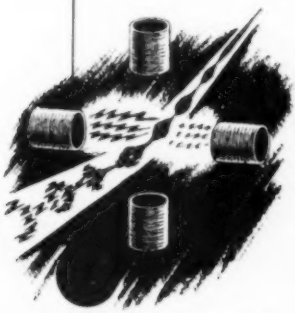
Control grid modulates—varies—the strength of ion-electron beam, matching it to the received signal.

Electron and ion particles are emitted from the cathode in a loose beam.

High voltage, applied through glass and conductive coating inside bulb, gives beam a final burst of speed.

Focus coil acts as a lens, but does it magnetically. It concentrates the spread-out beam to pin-point sharpness.

Tube cutaway by Sylvania Electric. Drawings by Ray Pioch



Deflection yoke around the neck of the tube bends the focused beam across the tube face and up and down.

Tube face is coated on inside with fluorescent phosphor. Phosphor lights up as electrons strike it. Amount of light is governed by the intensity of the beam.

Scanning action of deflection yoke moves beam across face in 1/15,750 sec. Beam makes two interlaced half pictures. Trace 1 (white) draws 262½ lines in 1/60 sec. Trace 2 (red) then does the same in the spaces between trace 1. Resulting picture consists of 525 lines drawn and erased 30 times a second.

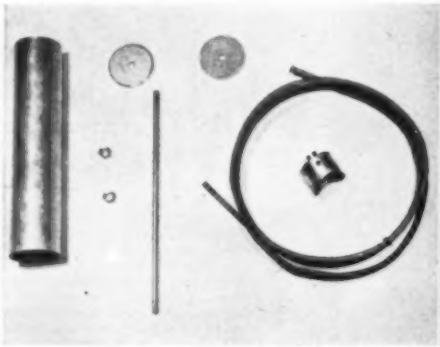
How an Expert Builds a Model Boiler

By Harry Walton
PS Photos by W. W. Morris

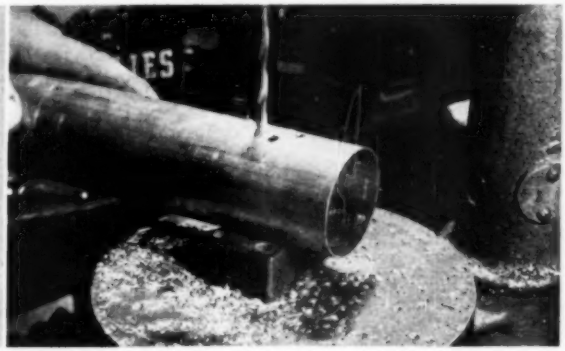
YOU can run a model steam engine on an air line, which is about as exciting as plugging in an electric motor. But when you use fire to boil water and let steam push the piston, you not only have a prime mover, but also a thrill that only the smell and spit of live steam can give. And cutting loose from the air hose gives you a nice portable power package for driving a model.

But even a small boiler, if badly made, can be dangerous. Water in a confined space stores heat as latent energy. Any sudden release of pressure, such as the rupture of a seam, lets it all flash into steam instantly, producing an explosion.

To find out how an expert builds *safe* model boilers, PS went to see Anton Bohaboy, of Rahway, N. J., who has been build-

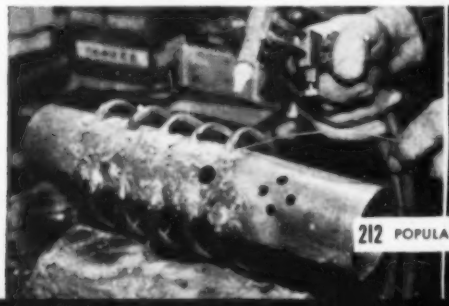


Here are parts for the boiler. A ¼" stainless-steel stay is threaded ¼"-20 at both ends. Water tubes are common copper tubing. Dome is built up of 1/16"-wall tubing and 5/32" disk.

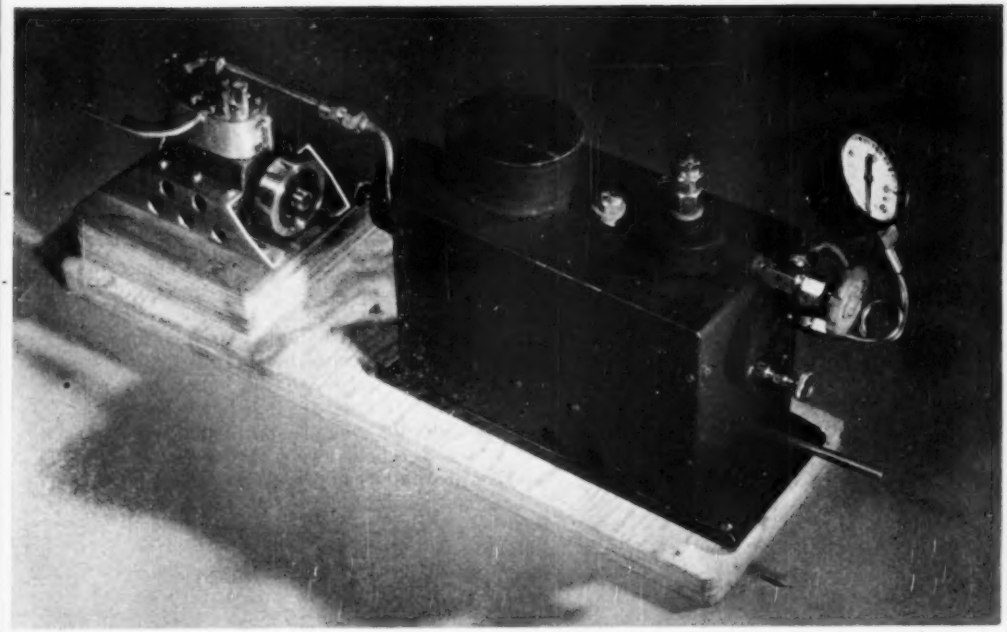


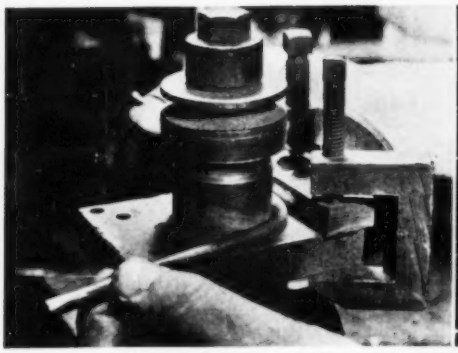
To insure dry steam, dome goes over four holes drilled in boiler shell. Shell ends must be square and without burr so end disks will fit well. Holes for water tubes are staggered.

The heat's on, applied with a small gas-oxygen torch that affords close control of the heating area. As the metal turns bright cherry red, silver solder in wire form is fed in.



With all tubes in, the stay is threaded into one end disk and pushed through a plain hole in the other. Disks have outside chamfer for solder fillet and are push fit in shell.



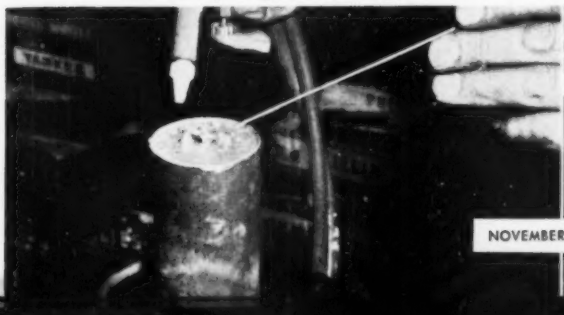


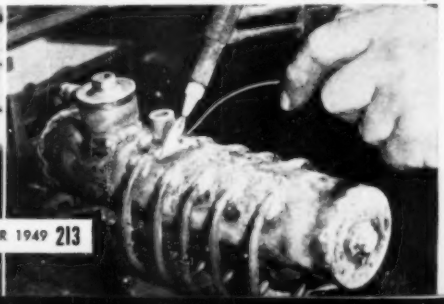
Pieces of copper tubing are bent to an open O shape on a jig. Correctly made, they have to be sprung into holes, which are cocked to suit by inserting rod, bending to position.

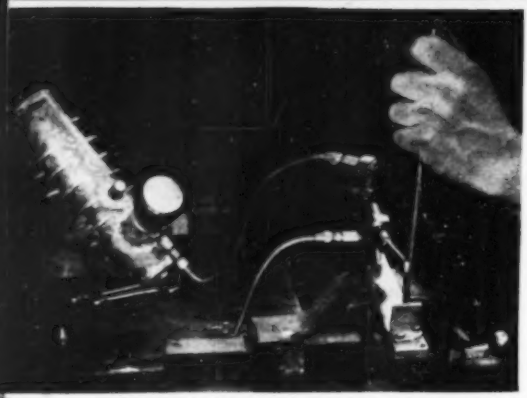
Silver-soldering flux is applied with brush. Anton Bohaboy uses commercial flux instead of borax. Note how upper ends of tubes protrude into shell. Lower ends are more nearly flush.

Nut is screwed on each end of stay. Then disk is silver-soldered to shell all around. Both nuts are sealed with silver solder all around and on top to prevent leakage.

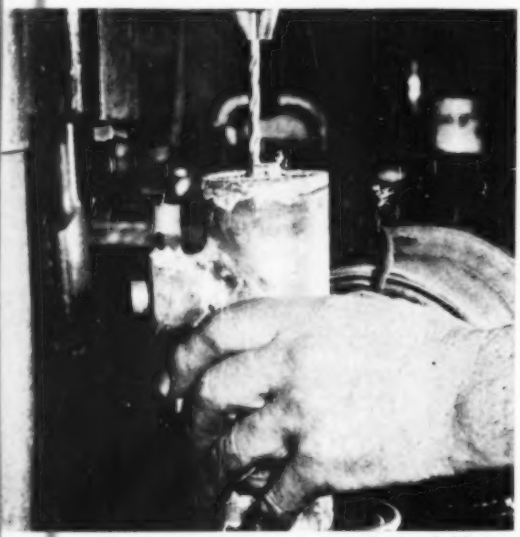
Dome, shaped saddle fashion to fit shell, is brazed over four holes. Filler nipple goes over large hole nearby. Silver solder used flows at 1,200°, and has ample strength.







Boiler gets first test. Gauge is put on, shell filled completely with water, and small force pump connected. At 200 lb., pinhole leak was revealed. Quick work with torch sealed it.



After second test, in which boiler held 300 lb. pressure for an hour, fittings were taken off and holes drilled for steam gauge and try cocks. Next, washing in hot water removed flux.

ing them for 28 years. A PS photographer and writer peered over his shoulder in his tool-crammed workshop as he built one. Starting with raw material cut to size, he wound up a few hours later with 75 lb. on the gauge and a twin-cylinder engine humming briskly alongside. The photos on these pages show how the job was done.

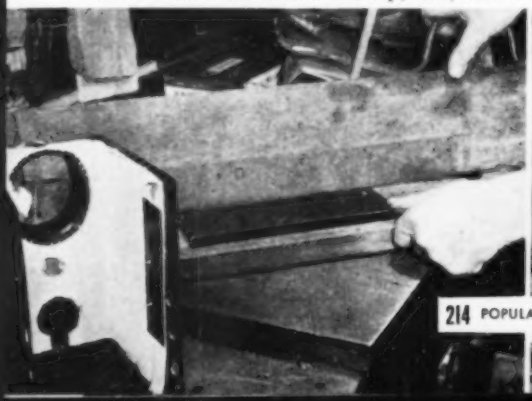
This boiler really steams. Showing pressure in about four minutes from a cold start, it'll run a ⅜"-bore, double-action engine about 25 minutes on less than a quart of water. Ten water tubes, a superheater coil, and an effective burner, all jacketed in an asbestos-lined case, turn the trick.

The joints are simple—they're butted and silver-soldered. But don't, Bohaboy warns, try to imitate this type of construction with soft solder. The boiler would be as dangerous as a live rattlesnake. Only low-pressure boilers can be built with soft solder, and then only if all parts are screwed or riveted for strength before any soldering is done. Silver solder, on the other hand, makes a joint almost as strong as the parts themselves. You need a gas torch for the work.

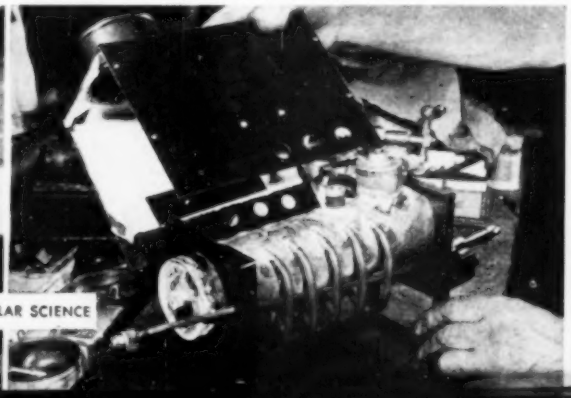
Safety valves, try cocks, and throttle are so cheap as to be scarcely worth making. Bohaboy prefers try cocks to a water gauge. Smaller steam gauges can be bought if one wants to stick close to scale size in details.

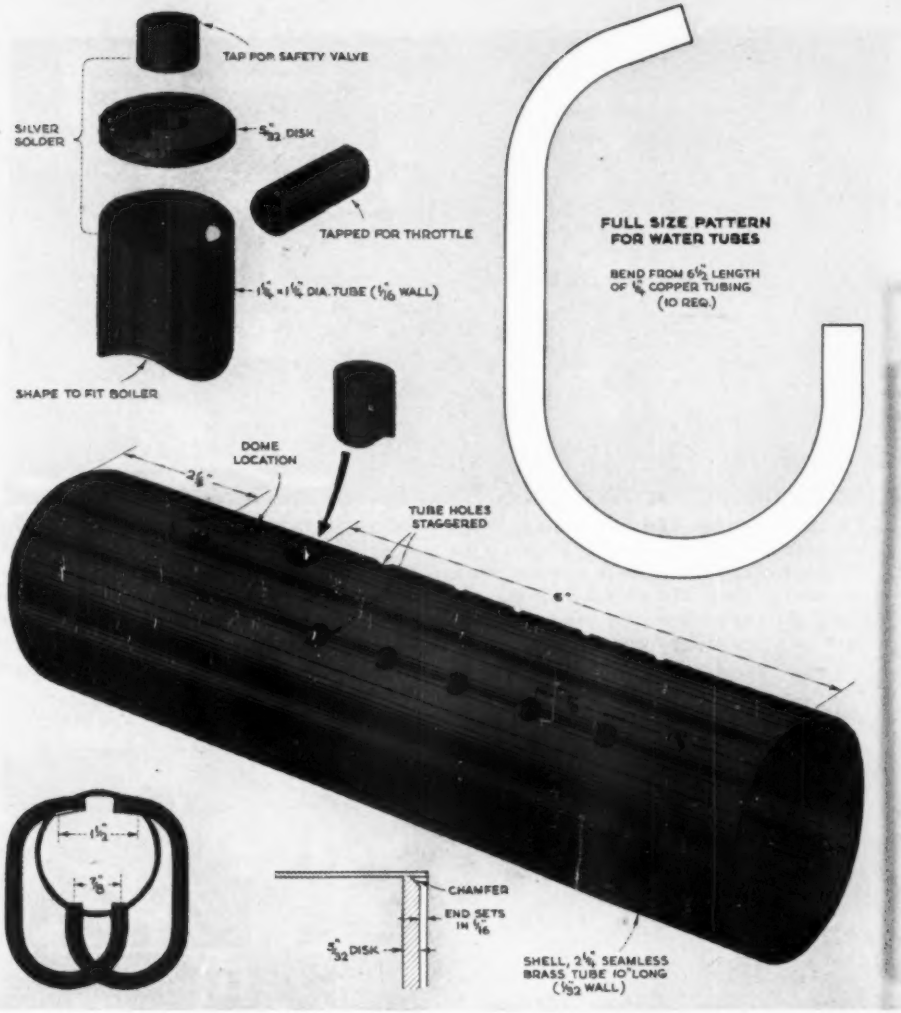
No boiler should be fired up until it has been given a hydrostatic test. One method is to fill it *completely* with water (plugging all openings) and with a gauge connected, lay it on a gas flame. Pressure will rise rapidly, but any rupture will harmlessly release the water. A better method is to attach a powerful water pump and build up pressure with this. Either way, no harm is done if the boiler can't "take it." Boilers are commonly tested to three times working pressure. END

Expert know-how enables Bohaboy to bend sheet-iron casing in a jiffy. Here he forms bottom on a homemade brake. Casing is asbestos-lined. Bead holds stack above top; tabs, below.



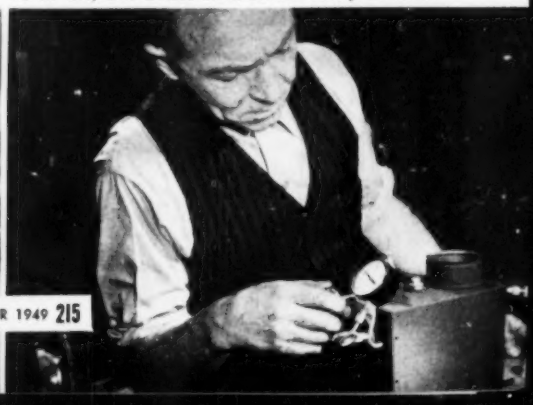
Shell slips into casing ends, and body over all. Horizontal tube is part of superheater, a 3' loop of 3/16" copper tubing running from throttle and carrying steam through fire.

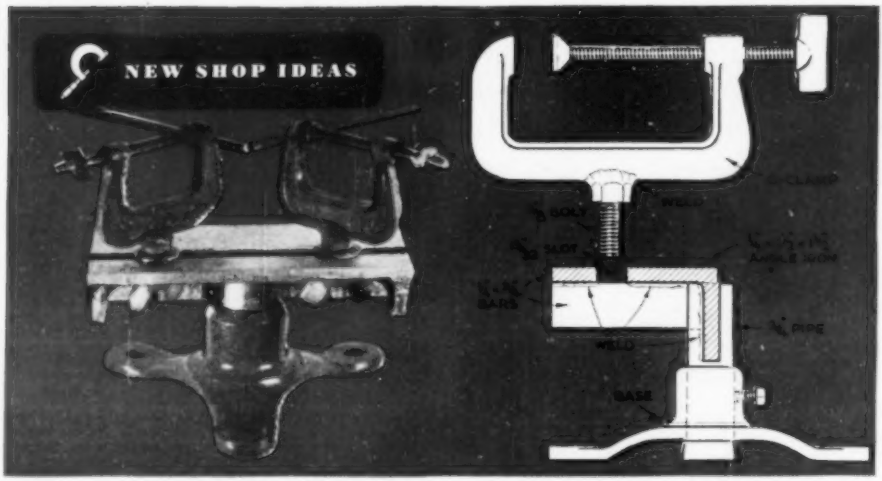




Safety valve is screwed into top of dome. The throttle has a big fiber wheel to protect fingers from heat. Gauge requires water loop shown to keep hot steam from internal parts.

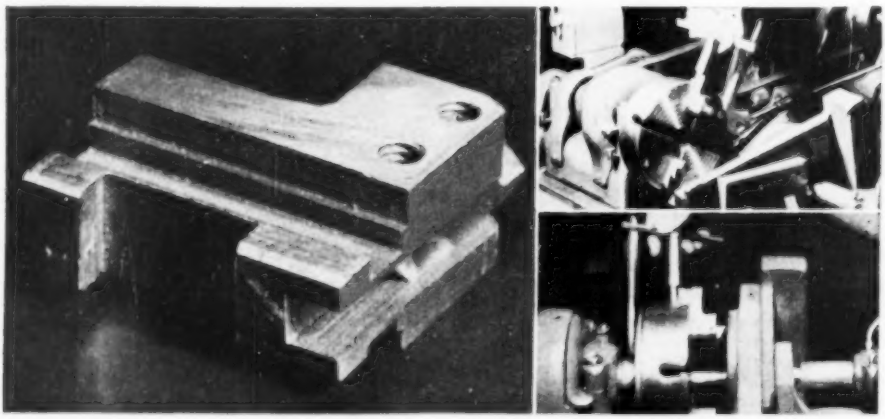
Alcohol is poured on asbestos in brazed-up sheet-iron fire pan. With water above try cock, Bohaboy fires boiler. Safety valve pops at 70 lb., but boiler held steam safely at 100.





Twin Clamps Aid Welding. When you have a welding or brazing job, it's often difficult to keep the parts in position while you use the torch. But with this rig you can clamp the parts where you want them and have both hands free for your work.

The base was salvaged from an auto junk yard. You can use any similar piece that is heavy enough to keep the device steady. The angle iron is fitted into a slot cut in the ¾" pipe. It is then welded as shown. The slot between the front and back surfaces of the table provides lengthwise adjustment of the 3" C clamps. Since the clamps swivel, your work can be held together at any desired angle.—*A. E. Kirk, Galveston, Tex.*

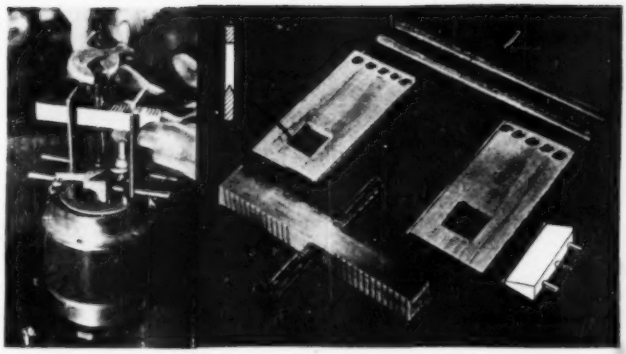


Expands Lathe Capacity. With this tool-bit holder you can face or bore any work that can be securely mounted and centered on the tool saddle. Just substitute it for one of the jaws of the four-jaw chuck.

For simple face milling, set the tool for a suitable diameter, revolve the chuck, and feed the work slowly across the lathe with the carriage locked securely on the bed. For boring and counter-boring, line up the work and keep it on center. Depth of cut is controlled by screwing the tool along the slot after every pass. The work is fed against it by advancing the carriage.

Machine the holder to fit the chuck closely—looseness would permit the bit to dig in. Harden and temper it. Mild steel is not desirable because it would loosen in use. Dimension the holder like one of the chuck jaws.—*A. W. Drieling, McKeesport, Pa.*

Gear Puller. The simple tool shown pulling the stop assembly from a Selsyn® unit is mighty handy for removing gears, wheels, and other assemblies from shafts. It also doubles in a pinch as a light-duty arbor press. It can be scaled to provide the power and capacity you need.



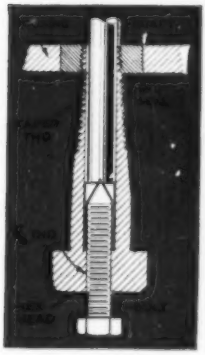
A lack of hooks distinguishes the device from the usual gear puller. Parallel rods passing beneath the gear or other part to be removed are used instead. These rods are held by two steel plates. Holes to receive the rods are drilled near the end of each plate. Toward the other end of each plate is a rectangular hole that receives the crossbar, through which a machine bolt passes. The notches in the crossbar can be made with a file, a saw, or by milling or grinding. File the edges of the square openings to an angle, as in the section above, to engage the notches.

Jaws that convert the plates into hooks can be attached by means of bolts and pins passing through the rod holes. Cold-rolled steel is satisfactory for the rods, although hardened drill rod is stronger. Shape the jaws as above.—*Walter E. Burton, Akron, Ohio.*

Lapping Trues Chuck. To recondition an eccentric lathe chuck without an internal grinder, try this:

Catch a copper or steel bar in the lathe tailstock and coat with prepared abrasive or a mixture of 200 grit Carborundum® and oil. With the eccentric chuck on the spindle, tighten the jaws to exert pressure but still let the chuck rotate. Feed the abrasive rod in and out of the rotating chuck. Test progress with a dial indicator. Then clean off all abrasive.—*L. W. Bonnell, San Diego, Calif.*

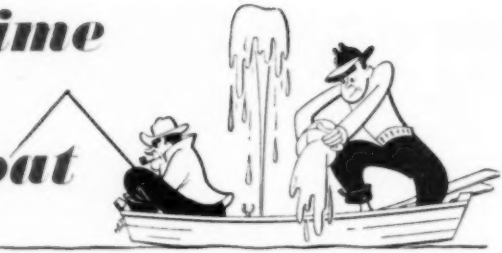
Tool Pulls Oil Seal. Removing an oil seal often gives trouble. This tool does the job without removing the shaft. Turn down a piece of stock to about twice the diameter of the shaft, taper and thread one end, and form a hex head on the other. Bore it through for an easy fit on the shaft and tap the big end for a suitable bolt. To use, turn the taper thread into the seal. Then turn up the bolt. This will back out the seal.—*G. Maresca, Brooklyn, N. Y.*



Jar Preserves Instructions. An ordinary Mason jar placed near your bigger items of shop equipment—drill press, lathe, power saw, etc.—makes a handy and safe place to keep operating instructions and other data pertaining to the tool.

Small accessory fittings and special tools can also be kept in the jar. If several jars are placed in the same location, roll the instructions with the title page out for quick identification when needed. Keep the jar sealed. —*Andrew Vena, Philadelphia.*

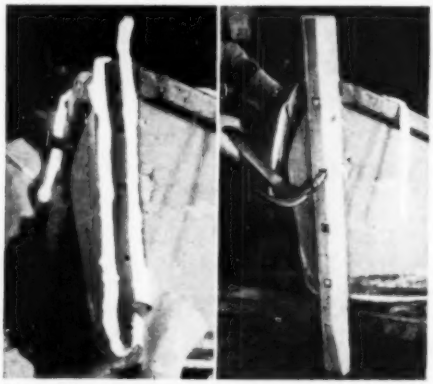
Now's the Time To Repair Your Rowboat



By Elon Jessup

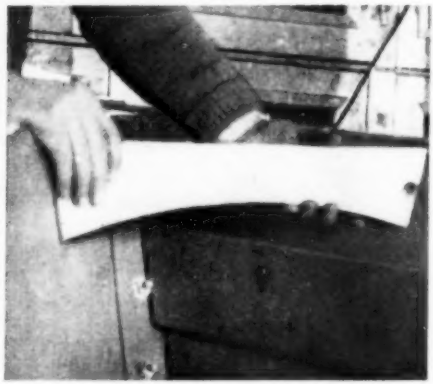
GOOD boats, like almost everything else these days, come high. A new plank here and there, plus a complete paint job, will put most old skiffs in first-class shape. Winter's a good time for such repairs, since small boats usually are stored during those months. Put in a couple of hours of your spare time now and then, and by spring your boat will be ready for the early fishing. Use sound, seasoned lumber and copper or galvanized nails. And you'll find that it pays in the long run to buy a good marine paint.

Skiffs are easiest of boats to replank. Drill for nails to avoid splitting sides. If there are chines, drive nails into them.



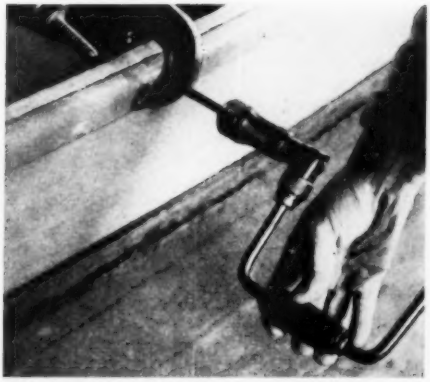
Use old outer stem as pattern for new one. Drill for bolt holes, calk, and put on new stem. If old bolts are badly rusted, hacksaw them.

If skiff isn't decked, install one. It adds strength to hull and a dry spot for a lunch. Blocks for deck are being screwed to sides here.

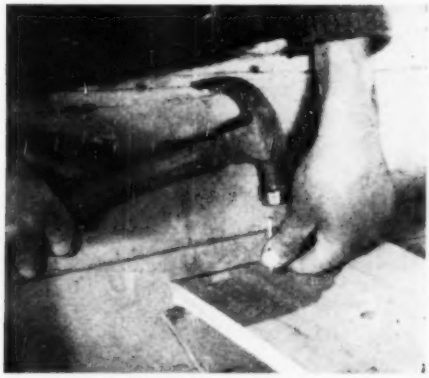


Sturdy crosspiece under rear of deck gives you a handhold when you're beaching boat. It keeps the strain off the deck planking.

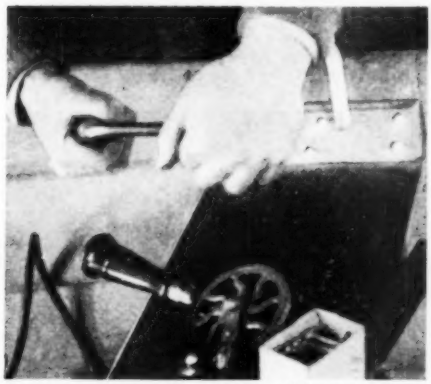
Battered top and guard rails are usually best replaced. Start at bow, bending and clamping hardwood strip in place as you drive screws.



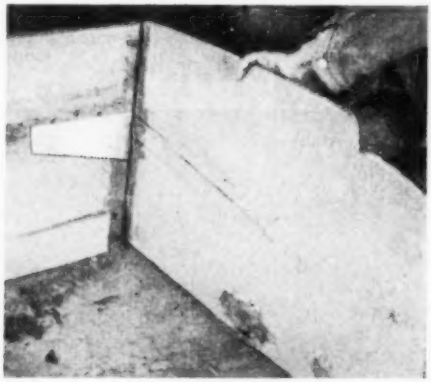
Watch for side planks that are pulling away from frames. Pull them up tightly with a C clamp and put in new screws wherever needed.



Seats help hold a skiff's sides together. Replace warped or rotted ones. Nails into the support will do for this part of the repair.



Seats won't buckle if you add extra cleats above. Cut pieces as long as the seat is wide. Clamp down on top of seat and screw to the side.



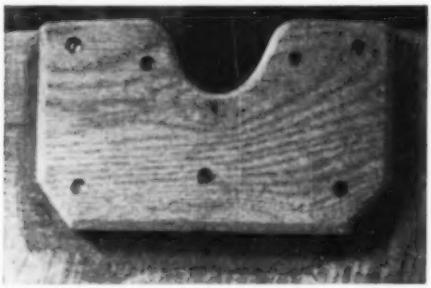
It's easy to take out an old transom without harming good sides and bottom. Use a metal-cutting saw to cut through nails.

View of the stern after old transom has been removed. New supports are being fitted. Use boat clamp or rope to hold sides at proper angle.

Here the new transom has been cut and screwed in place. It's made up of two planks, calked at the joint. Seat support is being fitted.

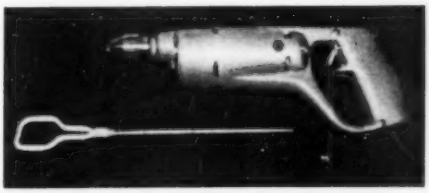
New stern seat of two planks is being installed. Notch two corners of the aft plank to fit around the two supports at the stern.

Final touch that's often overlooked is angled sheet copper on stern corners to protect them. Drill and fasten with copper nails.



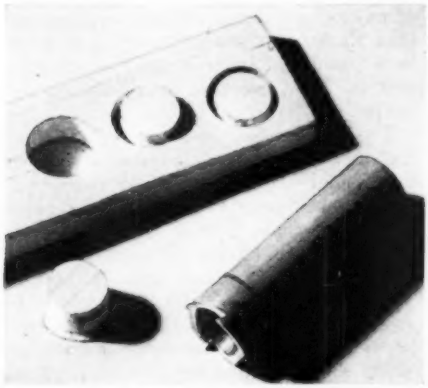
A reinforcement like this at the scull notch will save the transom from wear. Maintaining notch shape also makes sculling easier.

Now you're ready to sweep up all chips and sawdust. Paint the inside of the skiff first, turn it over, and paint the bottom and outside.



Let Your Drill Stir It

EVEN the messy job of stirring a gallon of paint becomes simple if you let your electric drill do the work. A paddle to fit the chuck can be made by adding a shaft to an impeller from an old kitchen mixer (top photo), or simply by twisting a loop in the end of a metal rod. The best way to handle the paint (inset) is by removing the lid of the can, drilling a hole in it, chucking the paddle through the hole, and replacing the lid. That way there's no splashing. *—D. H. Ross, Ridgewood, N. J.*



Scrap Tubes Make Plug Cutters

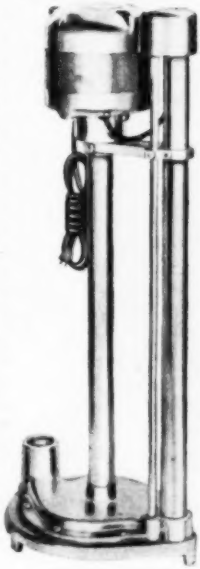
DON'T throw away scrap ends of brass tubing. A few minutes' free-hand filing converts them into excellent plug cutters. Choose tubes for their inside diameters—a ½" tube cuts a plug to fit a ½" hole.

Plugs ½" or bigger should be made in a lathe. Chuck the cutter, hold the wood against the tailstock pad, and feed into the cutter. Cut part way, then break the plugs out.—*Herbert R. Pfister, The Bronx, N. Y.*

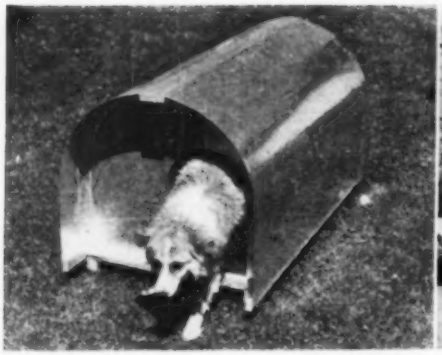
C Clamp Insures Smooth Siding

BOARDS for siding sometimes warp so that they won't fit snugly when you come to nail them on. To overcome this you need only a C clamp and a lever (any strong bar). Fasten the C clamp to the joist about level with the board top. Using the clamp as a fulcrum, force the board down with the lever until it fits smoothly against the one beneath.—*Charles Hedges, Clearwater, Fla.*

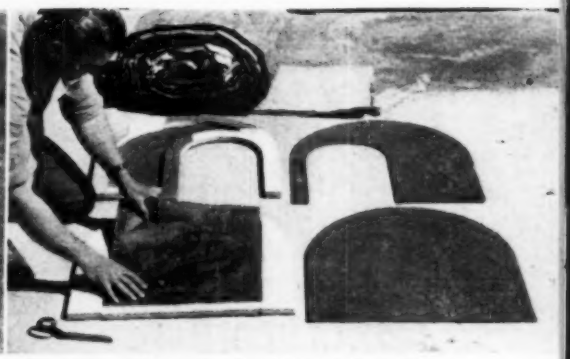
Air Pressure Starts Pump



THE usual water float is missing from a new kind of sump pump. Instead it has a micro-switch operated by air pressure. Water rising in a tube compresses the air in the tube until it pushes in a flexible diaphragm that closes a switch to start the pump. The new pump, called the Smooth-Flo® by its makers, Tokheim Oil Tank and Pump Co., Fort Wayne, Ind., is intended for industrial, home, or farm use. Made of aluminum, it weighs only 30 lb., yet has a capacity of 3,600 gals. per hour.



Sheet metal covers the hut. Here, the sheet was used on the ends as well as the top. Composition board or wood will serve for the ends, however, if it has been waterproofed.



These are the parts. Insulation is here being fitted into the framework of the back end. In background, note how the framing members of the front were neatly bandsawed to shape.

Even a Doghouse Can Be Warm

Insulated, leakproof, and draftproof, this Quonset hut costs less than $10 —and your dog will love you for it.

By Roland Cuevas

NO NEED to let your dog shiver out in the cold this winter when you can build him this insulated doghouse for under $10. Warm and cozy, it can also be towed easily from one spot to another on its two-by-four skid runners.

WARNING: This one's for a small or medium-sized dog. Change the dimensions for a big dog.

The floor and ends: These are 1" sandwiches of ¼" composition board with glass-wool batting in between for insulation. Cut two 24" by 36" pieces of composition board for the floor and two 24" by 24" pieces for the ends. Swing a 12"-radius curve to shape the top of the end pieces and cut on a bandsaw or jigsaw. Then cut the inside panel of each end 1" short so the outside will overlap the ends of the floor. Also saw the door opening in the front panels.

Cutting the framing: The frame for the floor consists of straight pieces of ¾" stock. Use a bandsaw to shape the end framework from stock of the same thickness. In the illustrations, the frame members are shown as pieces of regular width, but you don't have to be so finicky. The inner edges of the pieces need not be so nicely curved.

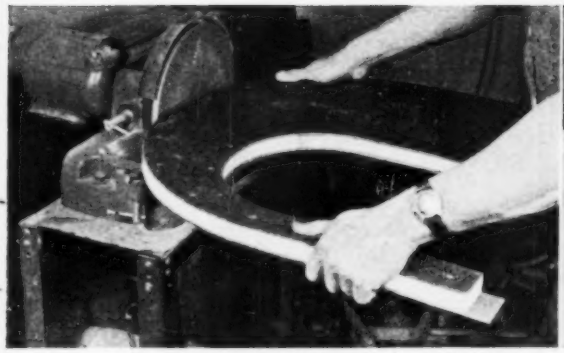
Assembling: Place the framing for each section on top of one panel. After cutting and fitting in the insulation, carefully clamp the second panel on top. Nail together, trim off any excess framing around the edges, and sand flush. Cut a ventilating hole in the back panel and frame a piece of screening over it. This hole can be covered on cold nights.

The ends can now be attached to the floor. Nail them from below and also through the overlapping parts of the outer panels. Set the assembly on the two-by-four runners and nail it onto these through the floor.

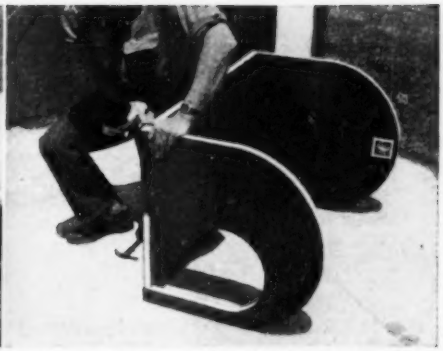
The inner shell: In this case, Tekwood® was used because it easily takes the bend across the top. But any composition sheet material that will take the curve can be substituted. You can determine the size of the sheet required by stretching a string around the curved panel and then measuring the string.

Attach this sheet by first tacking it to the edge of the floor on one side, and then bending it over the top to the other side, nailing it as you proceed. Use small wire nails with heads. Space them every two or three inches.

Now nail or screw the five longitudinal pieces in place. Then mark off and bandsaw curved members ¾" wide to close in the end spaces between the longitudinals. Install insulation all around.



Front-end sandwich is sanded smooth after its assembly. Note that outside composition-board facing projects beyond the frame. When the hut is assembled, this overlaps end of floor.



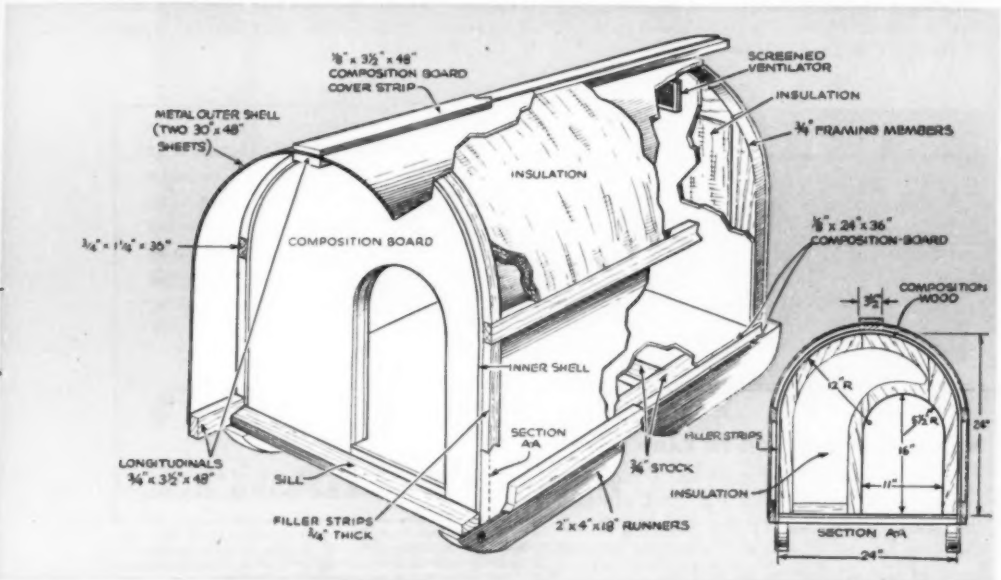
Ends and floor are assembled like this. Composition board was attached to frame with 1¼" galvanized nails. Driven through, these were clinched inside the ends and under the floor.

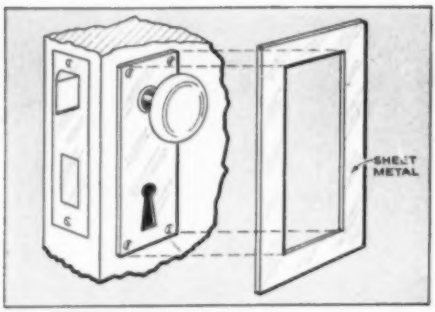
The outer shell: One standard 30" by 96" galvanized roofing sheet is sufficient. Cut it in half to make two 30" by 48" sections. Nail the sheets to the top and bottom longitudinal pieces and the filler strips, first punching the metal for the nails. Let the sheets overlap the top longitudinal by ½" on each edge. A cover strip of composition board or sheet metal goes along this seam.

A full-width piece of sheet metal could be used, eliminating this top seam and cover strip. But it is more economical to employ the standard roofing size—even if it's more work.

Finishing up: The final step is to fasten a slanted sill piece across the top of the runners under the door opening. Also drill a hole through the forward end of each runner. This will enable you to tie on a tow rope—or a long leash.

If the sharp ends of the sheet-metal roof bother you, slit sections of old garden hose lengthwise and slip them over the edges as a guard. END





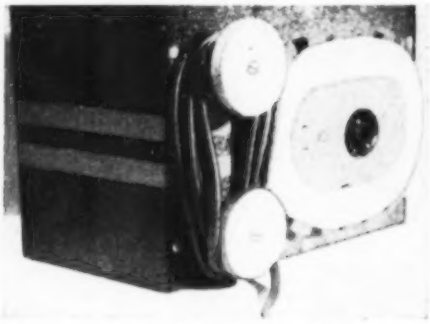
Polishing Shield Saves Paint

When an abrasive polishing material is used to shine up a door plate, the surrounding paint is apt to get marred. To protect it, I cut out this metal shield. It fits snugly around the plate and can be held with one hand while you work with the other. The cleaning woman who uses it is very enthusiastic.—*J. A. Appelquest, Leonia, N. J.*

Stop Roof Leaks Caused by Ice

Ice forming along the lower edge of a low-pitched shingle roof sometimes causes water to leak into the house. As snow melts, the ice dams up the water, allowing it to seep under the shingles.

This trouble can be overcome by placing a strip of roll roofing along the edge. Pry the nails from the fifth course of shingles, slip the roll roofing under, and renail.—*D. W. Allis, Billerica, Mass.*



Spools Take Slack in Line Cord

Sometimes the line cord on a radio or appliance is so long that the slack clutters the floor. Take this up by winding it on the two halves of a spool attached to the back of the appliance, as above.

Tape Breaks if Cracks Widen

A length of cellulose tape stretched over settlement cracks in plastered walls will show whether the cracks are continuing to open. Since the tape is inelastic, the slightest opening of the crack will break it.—*R. Daily, Long Beach, Calif.*

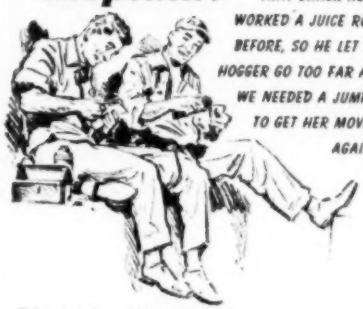
Space Shelves to Fit the Cans

Shallow shelves in a closet or area next to the kitchen can give you a little extra room for storing canned goods. Since the rows are only one-can deep you'll always be able to spot what you want at a glance. To make full use of the wall, space the shelves just far enough apart to fit cans of the most commonly used sizes.

Chain Length Identifies Bulbs

When bulbs of two wattages are used in a lamp to give dim or bright light, it's always annoying to turn on one when you want the other. But if the lamp is the type that has pull-chain switches, you can tell them apart by lengthening one chain.

Shoptalk: "THAT SHACK NEVER WORKED A JUICE ROAD BEFORE, SO HE LET THE HOGGER GO TOO FAR AND WE NEEDED A JUMPER TO GET HER MOVING AGAIN."



What are they talking about? Where do they work? Answer below.

They're railroad men. The brakeman hadn't previously worked on an electrified division, and he permitted the engineer to overrun the end of the third rail, necessitating the use of a temporary cable connection to permit the locomotive to back up into contact with the third rail.

Cards Your Friends Will Enjoy Saving

By W. W. Morris

Chief, PS staff photographers

YOU'RE looking at one of my family's series of Christmas cards. Maybe you would like to start a similar series this year.

I began making photographic cards for my customers while managing a store. We made the cards from stock or master neg-

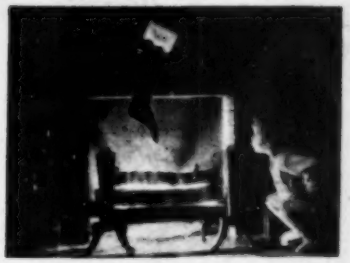
1939. Friends recognized my wife's handwriting and asked how we got it on the card. I copied her writing on 5" by 7" film and cut my own hole to fit the family picture.

atives, about 6" by 8", on which "Merry Christmas and Happy New Year" had been photographed. A space to fit either a 120 or 116 film had been cut in this. By simply inserting the customer's own negative of his child or home, the card was made as a contact print.

Later we cut an additional slot in the master negative to insert the sender's name. The names were set in type, hand proofs run off on glazed paper, and photographed on process film. This was developed in a special high-contrast developer and fitted to the slot in the master negative.

In 1939—I was then a proud father—we sent our first family card. It was amateurish, but the start of an interesting game. The next year we decided to make that year's card and all future ones to the standard size of 5" by 7". By 1945, making cards had become a habit. But getting a new idea and producing a better card were becoming more difficult.

Last year we wanted a television card and hit on the idea you saw on the preceding page. Centering the children's attention and backlighting them to make it look as if the light were coming from the set was the first step. No image showed on the television screen. So that part of the negative was carefully cut out. Then a friend shot me in a Santa suit and I made the negative to fit the hole in the larger one. The density of the two negatives had to be equal and the fitting done carefully. A third negative carrying the lettering was sandwiched with the other two between glass, and the cards made by enlarging the three negatives together.



1942. Message was printed in bold letters, copied, and print enlarged to fit blackboard. Photo was shot with backlight and 88-in.

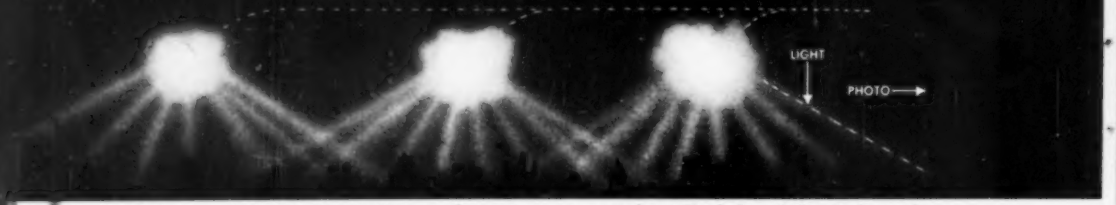
Said Peter to Bill
"This Choo-Choo says 'Woo-Woo'"
And from the Morrises
this means
Merry Christmas and A Happy New Year
to You

"Happy Christmas to all,
and to all a Good Night"

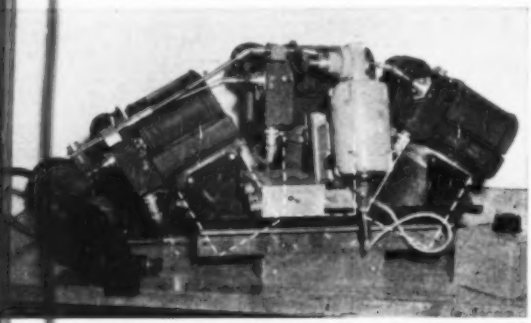
The Morrises

FOR CHRISTMAS
FOR NEW YEAR
FOR ALWAYS
Best Wishes
THE MORRISES

How Air Force Snaps Night Photos



Lighting up New York's skyline as shown in the artist's sketch above, successive flashes were produced by 14-ounce, 50,000,000-candlepower cartridges. Exploding behind plane, they created shadows, enabling interpreters to measure heights of buildings seen in the photo at right.



Photos were taken by three Air Force K-24 aerial cameras set in a trimetrogon mount as shown in photo above. Each camera has an f/2.5 lens with a focal length of 7½ inches.

Trimetrogon arrangement of the cameras makes it possible to take one vertical and two oblique shots for every flash cartridge exploded. Each burst lasts 1/1,000 of a second.

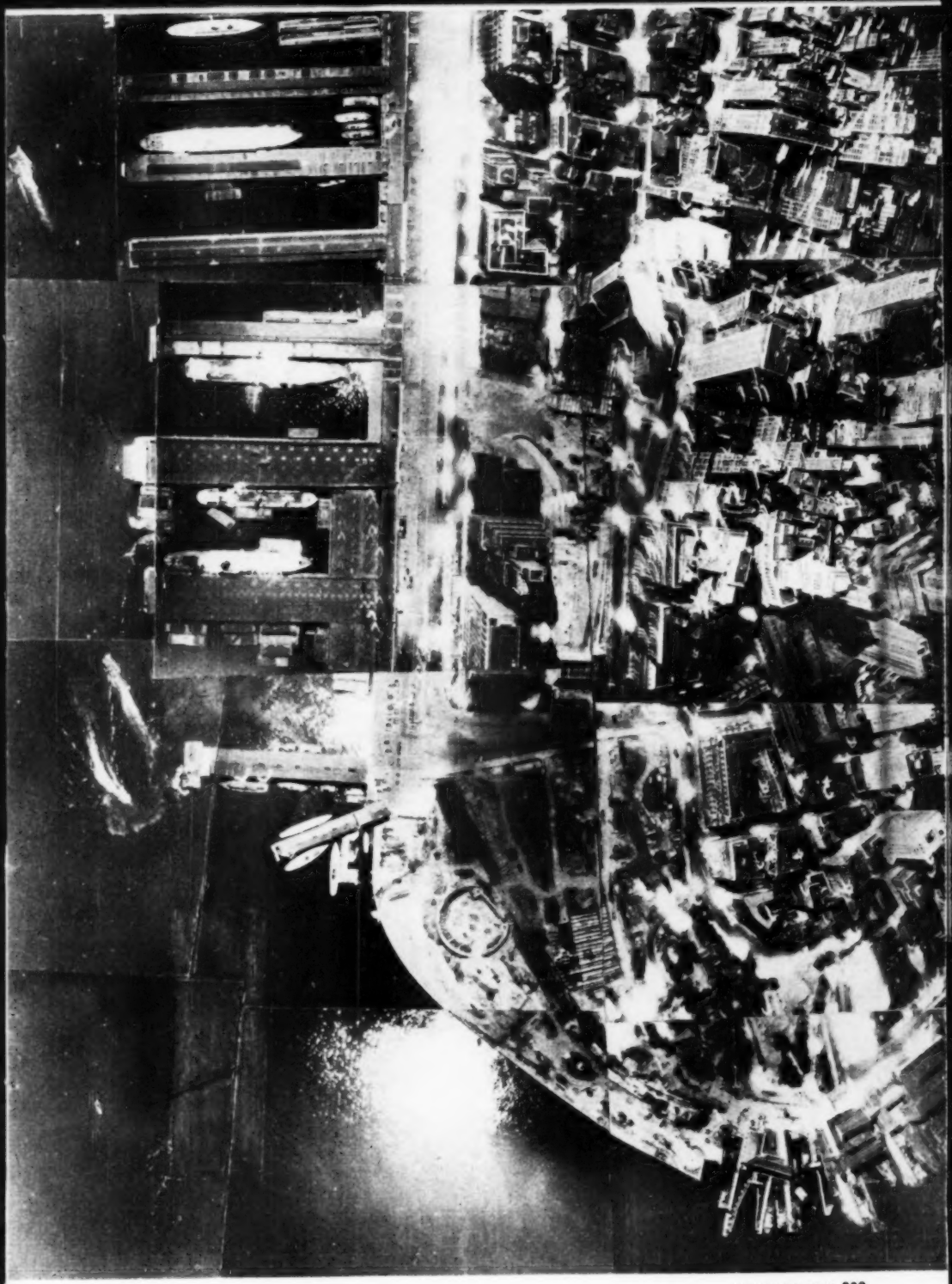
LOWER Manhattan was recently the guinea pig for a new system of low-altitude aerial night photography. And although New Yorkers were disappointed in not getting the spectacular display of sky fireworks they had expected, Air Force technicians were highly pleased with the results.

Photographed from 2,500 feet by a B-17 Flying Fortress speeding at 175 m.p.h., Hudson River piers, ferry slips, buildings, and streets are clearly identifiable in the mosaic at the right. So sharp is the detail that an Air Materiel Command spokesman claims that sections of the mosaic can be blown up to identify makes of cars parked along the dock front.

Previous methods of night photography were unsatisfactory because a lack of shadows made it impossible to determine heights and vertical contours.

Secret of the new system is a 14-ounce, 50,000,000-candlepower photoflash cartridge that is ejected and timed so that it explodes from 500 to 1,000 feet behind the plane. This provides plenty of shadow detail by separating the light source and the view of the cameras, making possible night photography comparable to daytime photography.

During the photo run, the camera unit not only speeds along in the plane, but the film moves continuously through the camera. Between flash intervals, the film moves at a slow rate of travel, keyed to the ground speed of the airplane, thus preventing blur. Then the flash cartridge explodes, and the picture is taken. Immediately a photo cell picks up the light, throwing the film into high speed. This whips the exposed piece of film onto a take-up spool, placing a new section of film in place for exposure.



Finished model will fit nicely into your HO layout. Use the same stations, but raise them.

Monorail Streamliner for the Young Railroader

Here's a train that's different—and fun for a craftsman to build.

By Herbert Lozier

EVERY rail fan in your neighborhood—even the fellow who has every train, track, and switch that Lionel makes—will envy the boy who gets a sky train.

Monorails have been used in Europe for years, holding down some of the toughest jobs in railroading – mountain and river jumps where surface rails are impractical. A hanging train won't jump the track because its center of gravity is just about as low as it can get.

You can use standard HO rail and wheels to build this layout. The locomotive body should be large enough to house one of the common surplus 24-volt DC motors, which you can pick up for about $3. They'll run well on a lower voltage, and can be reversed by switching polarity.

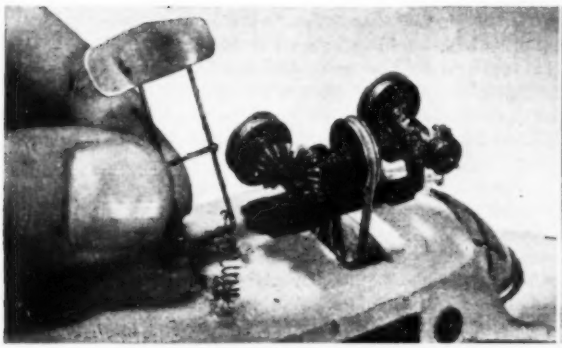
Installing the motor: Solder a ½″ brass pulley on the drive shaft and center the motor on a 3/16″ by 1⅝″ by 6″ wood floor so that the pulley is parallel with the front end but 1″ back. Fasten it with bolts if the motor is tapped for them, or bend a metal strap over the motor and screw the ends to the car floor.

When the motor is in place, butt the ⅜″ by 1⅝″ by 1⅝″ wood back to the back end of the floor as shown on page 233, and secure it with glue and small brads. Install another upright ⅜″ from the front edge. Since this is butted to the face of the floor, it has to be 3/16″ shorter than the back.

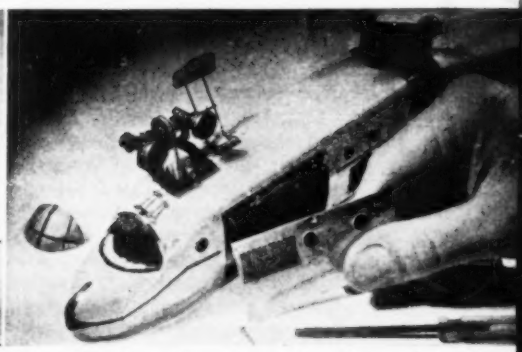
The roof is glued and bradded across these uprights. Its outer edges are rounded as shown in the section view; the top is flat.

Sight a line from the motor pulley to the roof and drill and saw an opening that will clear the rubber-band drive belt. Before you're finished with the roof, you have to carve a recess for the center truck coupling. The streamlined nose of the car is shaped from a 1″ by 1½″ by 1⅝″ pine block and the bottom is rabbeted to fit the overlapping front of the car.

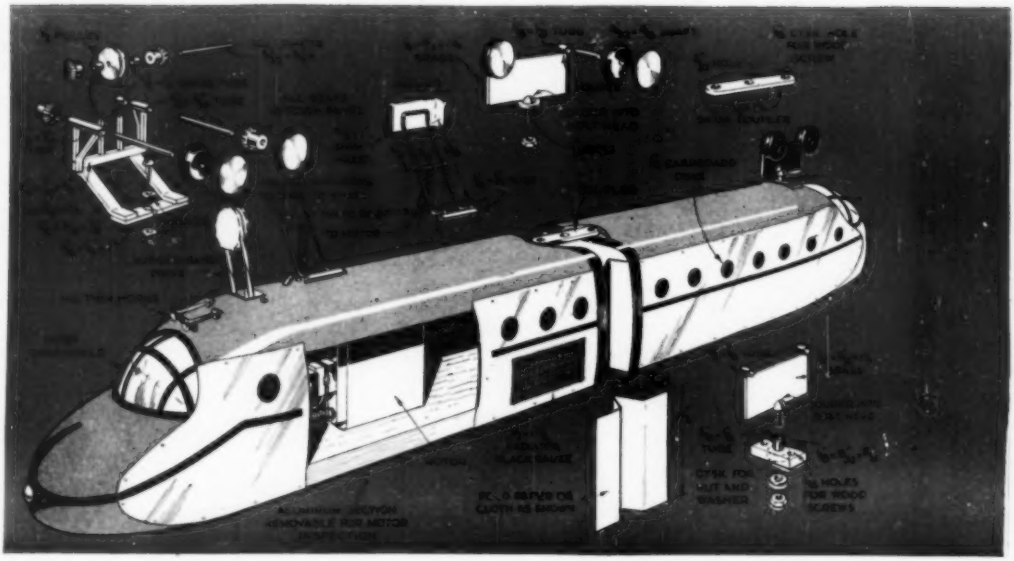
If you'd like a headlight on your model, drill a 3/16″ hole in the front to a depth of about ⅜″. Then drill a meeting hole from the back of the block. Make it large



Contact shoe rides against the higher track. Other side of the circuit is through the driver.



Inspection door allows access to motor on the side of the powered car that faces the pylon.



enough to take a 12- to 16-volt model-railroad lamp. Solder two wires to this lamp and insert it in the larger hole. The wires are later connected in parallel with the motor leads. As an alternative, you can use a pea lamp with a suitable resistor in series with one of the leads.

Fitting the Sides: Aluminum Venetian-blind slats are good material for the car sides and bottom, for they're very slightly curved, have a smooth finish, and are easily cut. Fit them carefully, and tack on the bottom piece if you like, but leave the sides off for the moment. You'll find it simpler to install the drive truck and the wiring if the sides aren't in the way.

Before going on to the running gear, build the remaining car or cars. The trailer is made in the same way as the engine except for the shape and size of the nose block. If you want extra cars in between, make them with square ends. Use paper or cloth for the connecting diaphragms. Make them the height of the car sides, and fold them as shown. Extra diaphragms at top and bottom will give the couplings an authentic look.

Constructing the Driver Truck: The running qualities of your monorail will depend chiefly on the driver truck. It is more important that the pieces match each other than that they conform exactly to the specifications in the drawing. All stock for the frame is 1/16″ brass. One leg of each fork is not dimensioned, since it has to be fitted by trial so that the brass bearing tubes come out horizontal and parallel to the base of the frame. You may find it easiest to solder on these supports after the axles, gears, and wheels are in place.

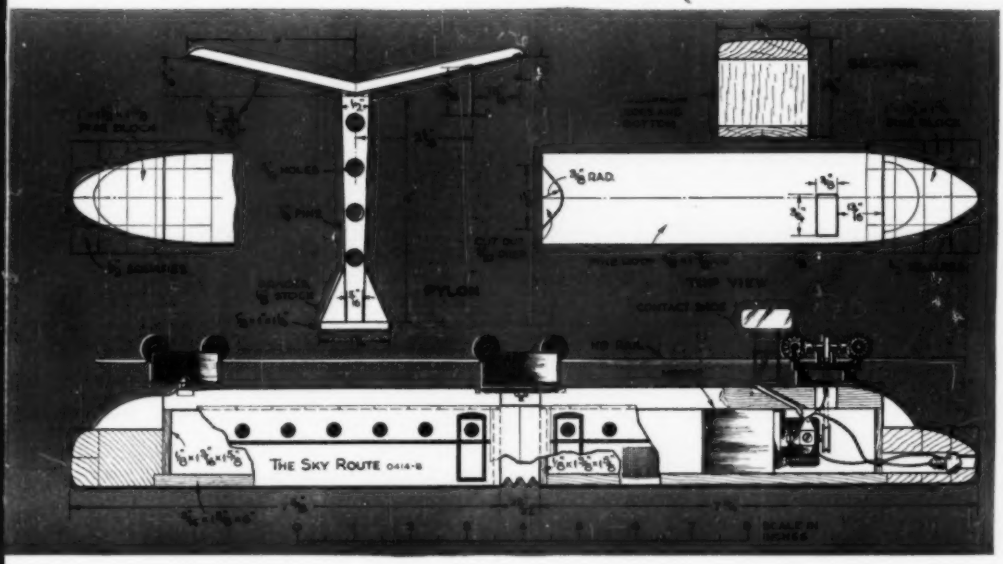
Cut off a piece of 3/32″ brass rod and solder a 15-tooth bevel gear—teeth facing out—at one end. Right behind the gear, slip on a length of ⅛″ brass tube as a bearing.

Next add the pulley wheel, soldering it to the shaft. Follow this with another length of bearing and the second gear, also facing outward. Solder the bearing tubes to the two center members of the upright. Make sure the pulley wheel is exactly centered and free to turn without end play.

Driving wheels are ordinary HO ones with brass flanges soldered on. The front wheel is soldered to the axle, the bearing tube slipped on, and the gear added at the far end, teeth inside. Try out the fit till you have the right amount of play. Solder the bearing to the forked upright.

For the rear driving wheel reverse the assembly. Put the wheel on first and the gear right next to it. This time the teeth point away from the wheel. Add the bearing, and then solder a short piece of tubing to the end of the axle to hold the assembly together.

Drill a pivot hole through the center of the frame base. Saw an opening across this hole to let a rubber band slip over the drive



wheel. When in place the band must be just tight enough to prevent slipping under load. Bend the frame if necessary to bring the wheels over the center line of the car.

Solder a flexible wire to one motor contact, bring it up through the belt opening, and solder it to the driver frame.

The contact shoe is cut out of shim brass and soldered to a frame of fairly stiff wire. Connect it to the other motor terminal by soldering the wire to the brad that holds the tension spring to the roof.

Test the driver unit by connecting a battery across the frame and contact shoe. The wheels should run freely in both directions, depending on the polarity of the connections.

You're now ready to add the sides. Remember to leave an inspection door, held on by small screws, on one side. The windshield is made of model airplane windscreen material. It's painted on the inside—grey with black lines—trimmed to fit, and glued on.

Wheel bearings for the center truck are mounted on a flat brass plate. Solder a flanged wheel to the axle and slip the axle through the bearing. Peen the end just enough to keep it in, or solder on a retaining collar. A roundhead bolt with the slot filed 1/16″ wide is soldered to the bottom of the brass plate.

The rear truck is made in much the same way although mounting methods and some of the dimensions differ slightly. Bear in mind that the pivot screws must be set slightly to one side in order to bring the wheels over the center lines of the cars.

Check the height and alignment of the wheels. If necessary, shim up either or both of the followers, or cut the mounting recesses slightly deeper to lower them.

Finish and Trim: Windows are ¼″ black cardboard disks (a paper punch cuts them neatly). Striping is cellulose tape that is painted black and cut to width before being stuck on. The motor-compartment grilles are heavy gauze. Aluminum sides are sanded to a clean, bright finish. You can pick your own color for the wooden roof and nose; the model shown is done in bright yellow.

Pylons: Track-supporting pylons are carved from pine and mounted 6″ apart on tieless rail bed. Cut a shallow V in the top of each upright so that the crossarms will rise as shown. The wood arms are glued in a T-shaped section; better build a jig for cutting them all to the same length and angle. Lengths of 3/32″ wire are clinched and cemented to the outer tips of the arms, and the track is soldered to the wire.

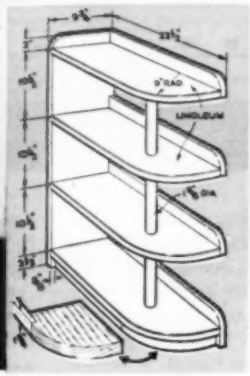
This model will take an 18″ HO curve with ease, so an oval track is your best bet for a long, smooth run. You can feed it from a battery or your regular model-train rectifier. Connect one wire to each rail, and just reverse the connections to make the train back up. END

Make it Now for Christmas

Handy Shelves Fit Odd Corners

ANY kitchen can use a few extra shelves—and they're the perfect answer for those odd-shaped, what-to-put-in-them problem spaces. The stand shown here fits neatly beside a refrigerator, but you can change the size and shape to fit your own needs.

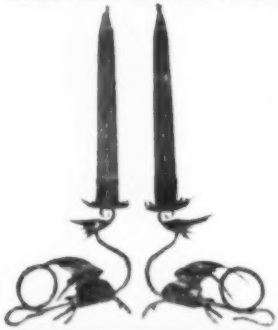
Use white pine and cover the shelves with linoleum. Rabbet the back piece to support the shelf ends.



The base is made of two pieces as shown, nailed to the bottom shelf. The shelf-support posts can be 1¾" round or square stock.

Glue on linoleum with linoleum cement, edge shelves with metal molding, then apply white enamel.—*John N. Michel, Holbrook, N. Y.*

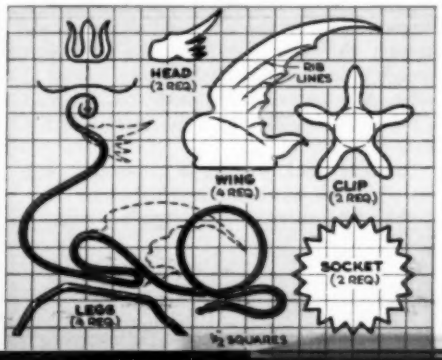
Guests Will Admire These Dragon Candlesticks



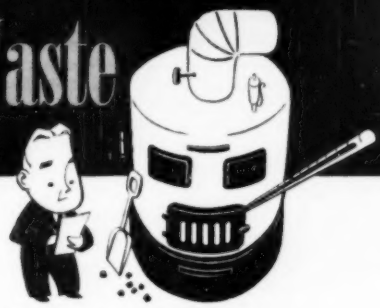
YOU can make these "fire-breathing" dragon candlesticks easily out of brass, copper, or aluminum sheet and ⅛" rod.

Form the legs and body from the rod, bent to shape as shown. File the tongue to a taper before coiling it and drill the rivet hole. File the tail. Solder the legs to the body.

Cut out the wings, head, and candle socket from the sheet stock. Hammer the ribs in the wings from the underside against a wood block. This will also cause the wings to curve so that little bending is necessary. Bend the wings and head over the frame and solder them on. Flare the long horns of the head slightly outward. Hammer the candle socket parts to shape, and rivet them on. Then polish and lacquer the candlesticks for a good finish.—*J. Brumfield, Philadelphia, Pa.*



Tracking Down the Fuel You Waste



You don't have to be a combustion engineer to tune up your heating plant for the winter. New kit makes job easy. Photo above shows measurement of draft in pipe to chimney.

By Walter E. Burton

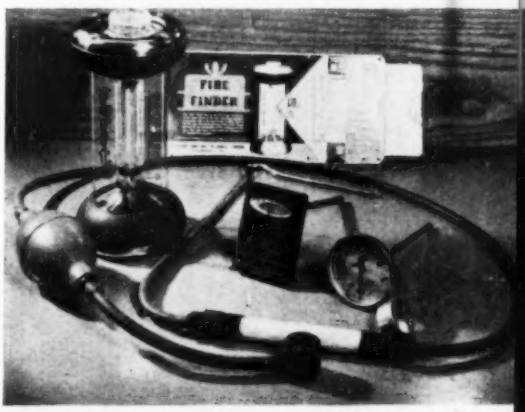
THE cold fact about home heating, the experts say, is that many people are paying for warmth they never feel. A lot of furnaces are operating far below their rated efficiency—either the fuel isn't being burned completely, or all the heat isn't being taken out of the gases before they escape up the flue. *As much as 70 percent of your fuel money may be going up in smoke!* Insulation, while reducing the total amount of heat required, won't improve furnace efficiency.

Until recently, there wasn't much you could do about it, except hire a combustion engineer to haul in his instruments, analyze your furnace's operation, and make necessary adjustments. Now, on several types of furnaces, you can do the job yourself. With a simple kit made by the Bacharach Industrial Instrument Co., Pittsburgh, Pa., you can tune up your furnace, just as you tune up your car, so that it gives the most heat for the least fuel. The kit, intended only for automatic furnaces, costs $40, but there's no reason a group of householders can't split the cost and share the use of a single kit.

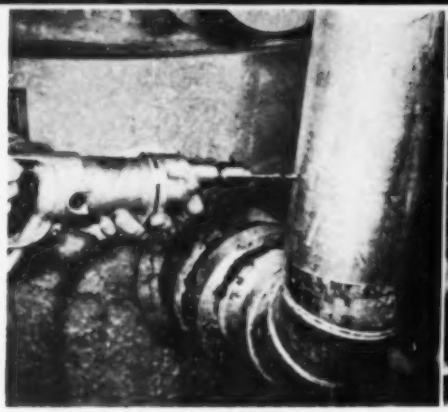
The kit has three easy-to-use tools:

- A gauge to determine the amount of draft;
- A thermometer for measuring flue-gas temperatures—obviously, you want the real heat in the firebox, not in the chimney;
- A device that analyzes the carbon dioxide (CO_2) in the flue gas. The carbon dioxide content should be as high as possible, for the carbon in the fuel that doesn't become carbon dioxide goes out in a form that could have burned.

The measurements these tools make are quickly converted into furnace efficiency with the kit's slide-rule calculator. A good oil burner should show close to 80-percent efficiency, but many run at efficiencies of 50 percent or even less.



This is all you need. Instrument at left measures percentage of carbon dioxide in flue gas. Draft gauge is in center, thermometer at right. Calculator (rear) does the arithmetic for you.



Small holes must be drilled or punched in smoke pipe and fire door to admit instruments. Holes do not affect furnace operation, but can be plugged up after tests with bolts or fire clay.

Most important draft measurement is taken by inserting gauge through hole in fire door. In some cases, it may also be desirable to measure draft in smoke pipe, below and above damper.

Rubber bulb sucks gases into glass container of liquid that absorbs carbon dioxide. Level of liquid after absorption shows carbon dioxide content. White tube removes moisture.

No pencil and paper are needed. Slide-rule calculator, called Fire Finder® by makers, Bacharach Industrial Instrument Co., gives efficiency directly from readings shown by instruments.

Let's suppose you want to analyze your oil furnace.

The first step is to drill or punch ¾" holes for the instruments—one in the smoke pipe below the downdraft diverter or damper, the other in the fire door. The holes are too small to affect furnace operation, but they can be plugged later with bolts if you like.

The thermometer is slipped into the smoke-pipe hole, the end of its tube being kept in the center of the pipe for about two minutes. You subtract the room temperature from the dial reading to get the net stack temperature used to figure efficiency.

The draft gauge has a jointed tube sticking out of its back. You put this in the test hole, keeping the gauge vertical. Then hold your finger over a second hole in the back of the gauge and move the gauge until the pointer is at zero. Now remove your finger and read the draft as shown on the dial.

To determine carbon dioxide content, flue gases are drawn by a rubber bulb through a metal tube and drying filter into a liquid-filled container. It takes about 18 squeezes of the bulb to fill the test chamber, which is then sealed by releasing pressure on a spring-loaded stopper. The container is next turned upside down to mix the gas with the liquid. The liquid absorbs carbon dioxide, indicating how much was present by its level in the container.

Let's assume you've done this and find your worst suspicions true—your furnace isn't running as efficiently as it should. What do you do next?

In general, the draft should be strong enough for complete combustion, but not so strong that stack temperature is very high. Carbon dioxide content should be high. Compare the values you measure with those

Temperature of flue gases is measured by sticking thermometer tube in smoke pipe, holding it there for two minutes. The handle prevents burned fingers—gases are about 600°F.

recommended by the manufacturer of your heating plant. If the manufacturer's specifications aren't available, use the ones listed below, which apply to most common makes of oil burners.

Gun Type. The draft over the fire should be at least .02″. If you measure draft below the damper, it should be .03″ to .04″; above the damper, it should be .08″ to .12″. The carbon dioxide content of the flue gases should range between eight and 10 percent. Stack temperature should be 550° to 600°F.; but may be higher in a coal furnace converted to oil.

Vaporizing Pot Type. The draft over the fire should be .02″ to .06″. If you measure draft below the damper, it should be .04″ at low fire, .05″ at medium fire, and .08″ at high fire. Draft measured above the damper should range between .08″ and .12″. Stack temperature should be 600° F. to 650°F., and the carbon dioxide content should be eight to 10 percent.

Dampers May Be at Fault

Damper settings and the fuel-to-air ratio of the burner are two of the first things to check. Other causes of low efficiency are shown in the chart at right.

While the Bacharach kit is simplest to use with oil burners, it can also check gas and coal-stoker furnaces. In these, however, a number of additional factors must be considered. The draft over a gas fire, for example, is too small to be detected with the gauge, but can be tested by observing the movement of a match or candle flame held near the furnace-door opening. Again, in analyzing coal-furnace operation the size and appearance of the coal bed must be taken into account. END

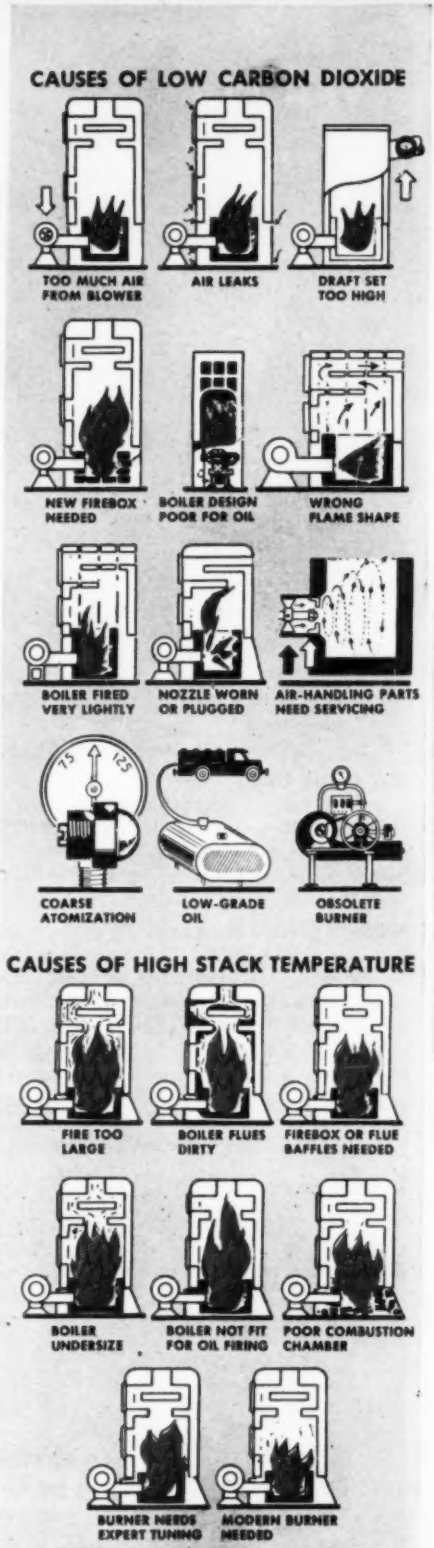
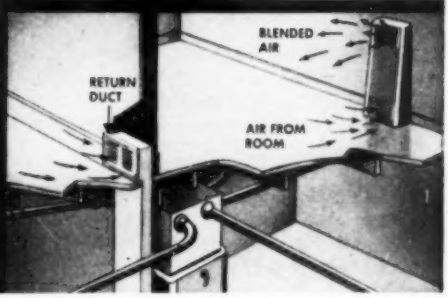


Chart by Bacharach Industrial Instrument Co.

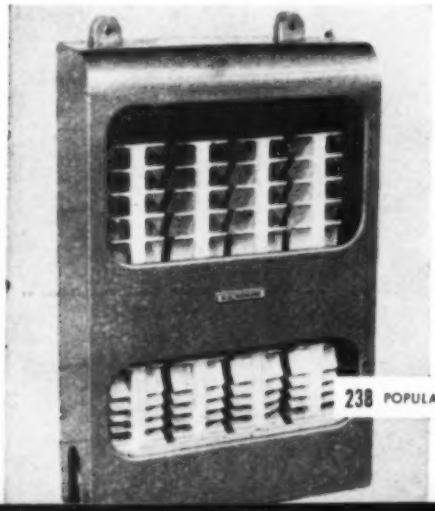
News in Home Heating

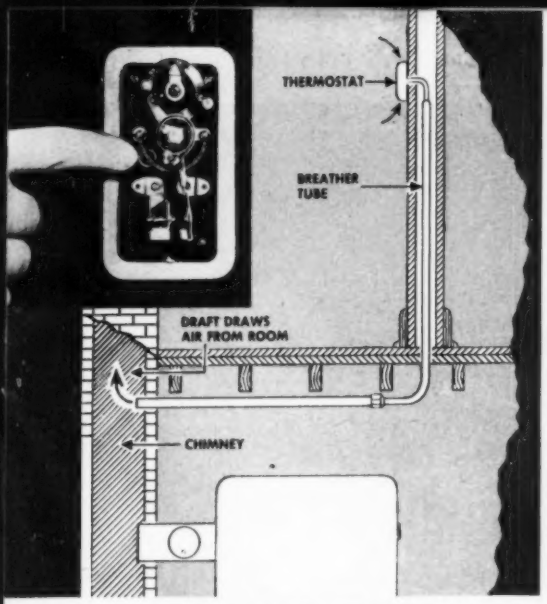


No Cold Feet. Even heating from floor to ceiling is the object of this Coleman warm-air recirculation system. Hot air from the furnace is forced through small ducts to blending units, installed in the walls or simply set in the rooms. Each blending unit sucks in air from the room through the bottom grille at floor level, mixes it with the hot air from the furnace, and discharges the heated mixture through the top grille.

Safe Space Heater. In areas where gasoline, cleaning fluid, or gas are in the air, the element of an electric heater could cause an explosion. In the space heater below the Electromode Corp., of Rochester, N. Y., eliminates this danger by sheathing the elements in a finned aluminum casting.

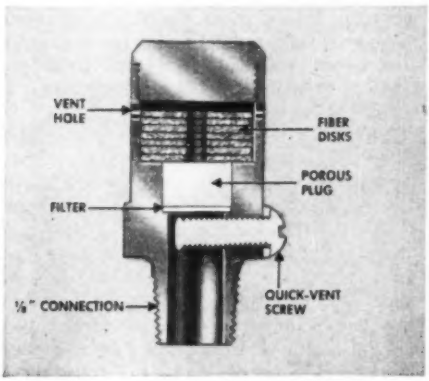
Heaters Shrink. You still can't put a home-heating unit in your pocket—but they *are* getting smaller. The Aldrich Company, Wyoming, Ill., says its waist-high oil burner, below, has more than enough capacity for a four- or five-room house. It can be used for steam, hot-water, or radiant heat.

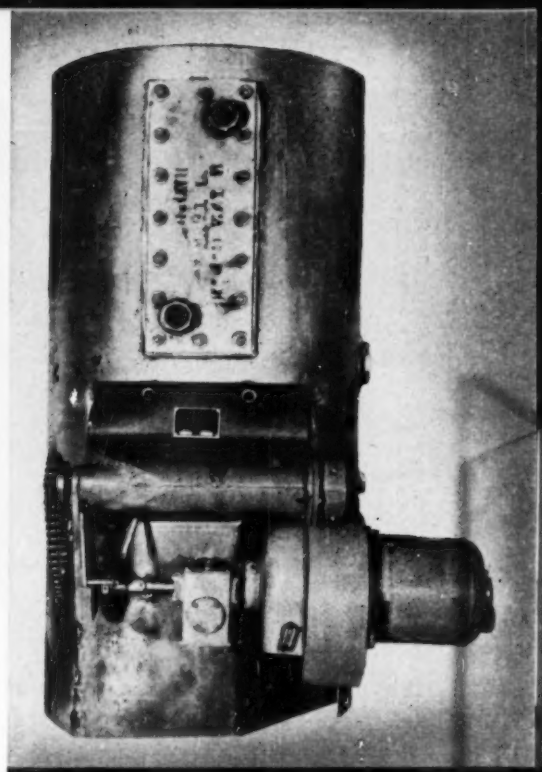


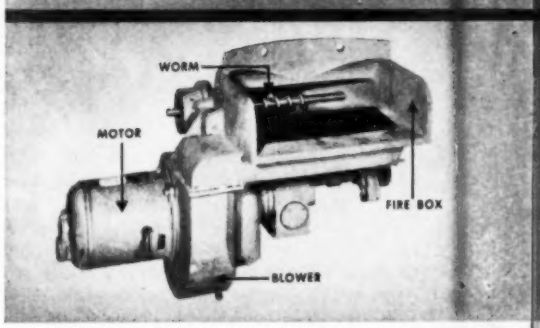


Draft Controls Heater. Breathe-O-Stat®, made by the McClarty Systems, Battle Creek, Mich., hitches operation of an automatic heating system directly to outdoor temperature changes. If wind rises or temperature drops, chimney draft increases, drawing more room air through the breather tube. This air cools the thermostatic control, which then allows the furnace to operate longer at a time, saving fuel. Finger (above) indicates the breather tube behind the control element of the thermostat.

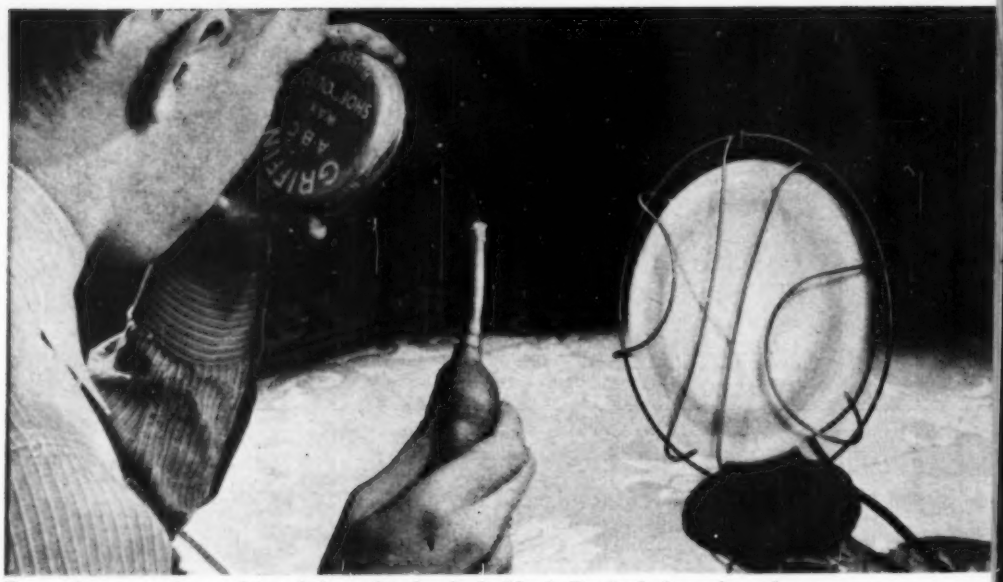
Radiator Freed of Air. A hot-water radiator must be kept free of air. The valve below, made by Taco Heaters, of Providence, does this venting automatically. After the air escapes, water swells the fiber disks, sealing the valve. As more air gathers, it redries the disks and is released.







Air Speeds Coal Heat. In a blacksmith's forge, a blower forces air through the fire for quick heat. The heater above, designed to burn inexpensive buckwheat and rice anthracite, operates on a similar principle. A fan blows air up through the bed of coals. A worm feeds coal from the bin to the firebox. When the thermostat demands heat, an electric motor operates both the fan and worm, the fan directly and the worm through a reduction gear and sprockets and chain. Besides feeding the fuel, the worm helps shove ashes off the sloping grate into a receptacle below. The Coal-O-Matic Company, Trucksville, Pa., developed the burner. It sells for around $400.



From where you sit, revolving disk on this fan looks blank. But look through stroboscope . . .

Amuse Your Kids with a Tin Can and a Fan

YOUR children will have fun, and learn a bit of science too, with this home-made, motion-freezing stroboscope.

With it, they'll be able to read words on a rapidly revolving disk. A fan will seem to stand still—or turn backwards. Half of a neon or argon bulb will glow brightly while the other half is dark. A clapper will ring a bell while apparently not moving. And many other things that are not tricks—but just science at play.

The basic stroboscope idea is very simple. All you need is a slit cut near the edge of a disk, a means of revolving the disk, and a housing that has a viewing hole in line with the circular path of the slit.

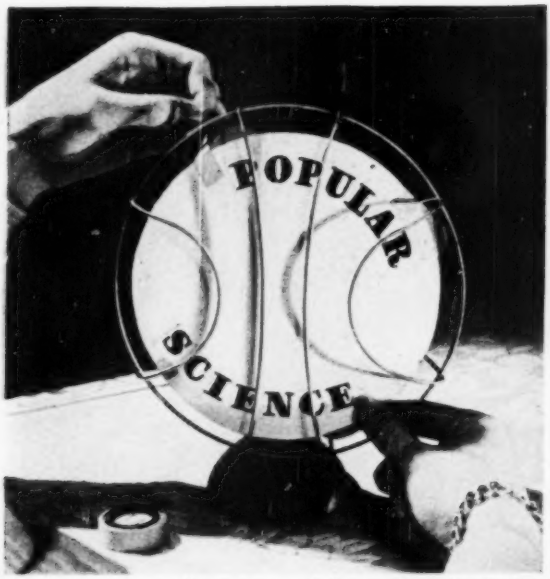
The surprising effects you get are produced by what technical people call persistence of vision. It works like this:

Suppose you look through a stroboscope at a revolving disk on which you have put some lettering. As the slit passes the eyepiece, you get a split-second view of the word. This image remains on your eye's retina for a fraction of a second. When stroboscope and lettered disk are revolving at the same rate, you get a succession of glimpses of the word at exactly the same spot in its circular path.

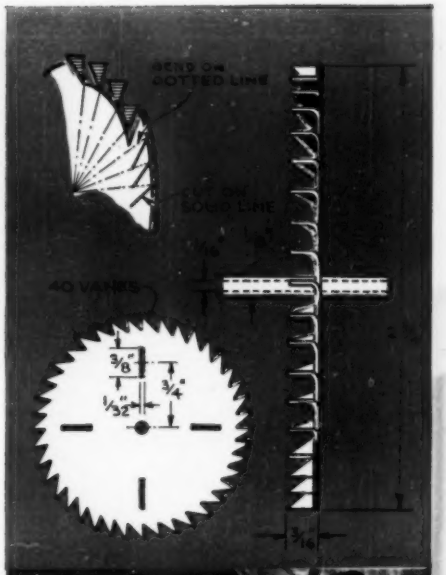
Persistence of vision blends these repeated impressions into what appears to be one image. As a result, you can read the word. For the same reason, fan blades seem to stand still. If the stroboscope is revolving faster than the fan, the blades will seem to move backward. In the same way, a stroboscope will slow down or freeze any circular or vibratory motion occurring at regular intervals.

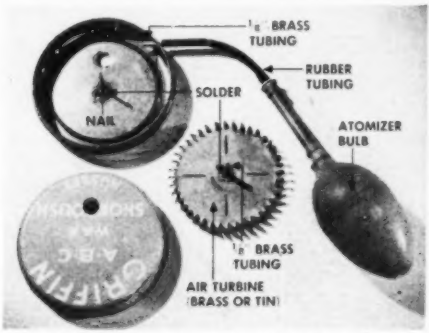
In the stroboscope shown, you revolve the disk by shooting a stream of air against the turbine blades. An atomizer bulb with a one-way valve is used for this. A shoe-polish can houses the disk.

Since air from a rubber bulb won't revolve the disk at a rate equal to a fan, it's necessary to have several slits in the disk. Four slits amount to the same thing as running a single-slit disk four times as fast. You get four times as many glimpses. END

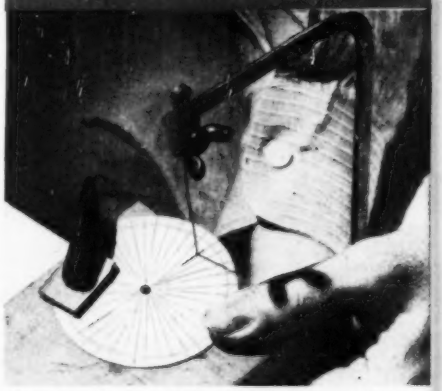


. . . and you can read the words quite clearly.



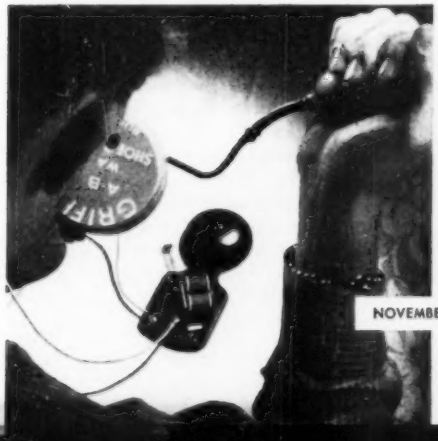


These are the parts. The air-turbine bearing slips over the nail shaft. In assembling, be sure to align peep holes. Note valve in bulb.

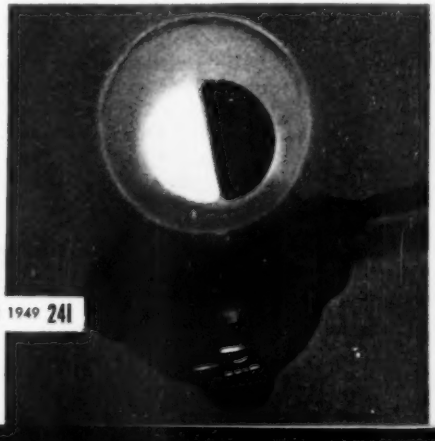


Slits can be cut with a jeweler's saw after you have made a hole with a small drill. A flat needle file will smooth the edges of slits.

Clapper of bell or buzzer appears to slow down or stop when viewed through the stroboscope. Rotate the turbine disk quite slowly for this.



Half a light. If you run stroboscope in step with each half-cycle of the current, one segment of a neon or argon lamp will black out.



Hide a Radio in a Skillet

You can use miniature parts to produce this attractive 5-tube superhet job for kitchen entertainment.

By Edward Blanton

YOU can brighten up your wife's home workshop—the kitchen—with a little frying-pan art of your own. This radio in a skillet can be hung among other pots and pans as a decorative addition to her kitchen that will supply music, news, and soap operas—and sometimes remind her that it's later than she thinks.

Decide first, if possible, where the pan will be hung. If it goes against a metal cabinet, the loop antenna may not work well, but an antenna coil can be substituted for the loop as shown in the diagram on page 245. Should you hang the set on a plaster wall or the side of a wooden cabinet or spice shelf, the loop will give good service.

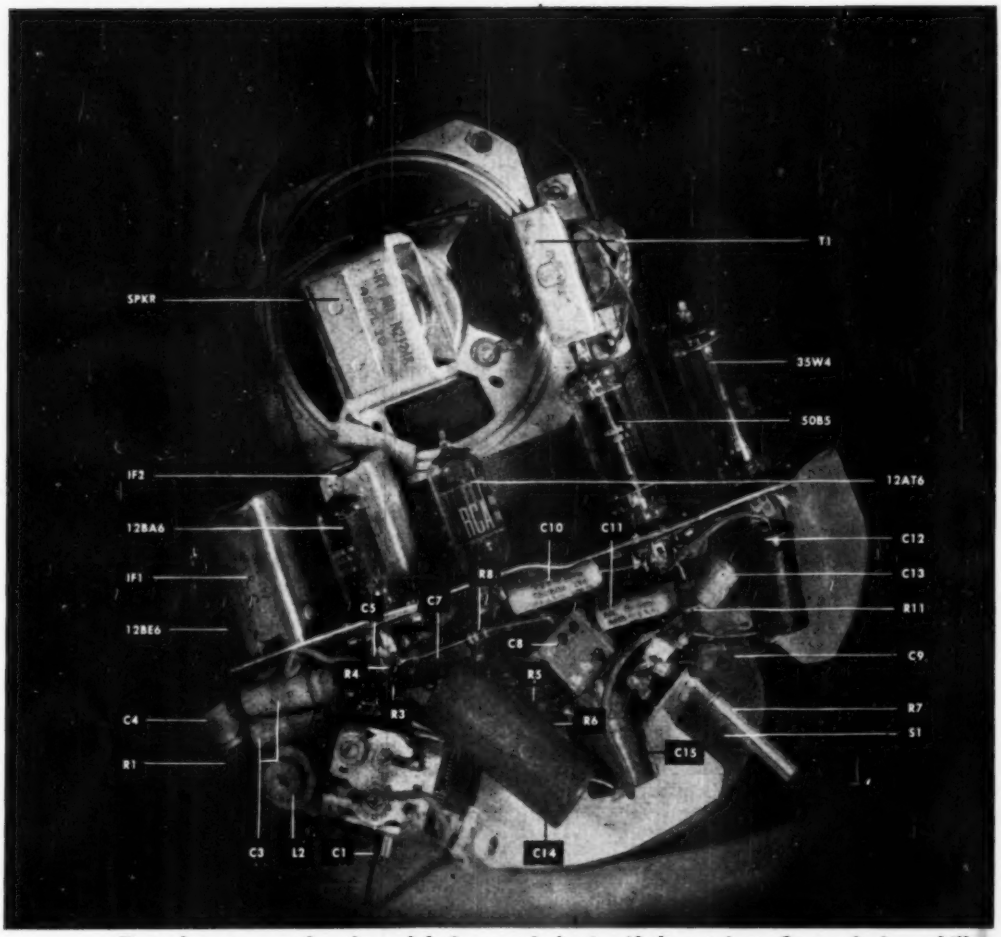
The circuit is a standard five-tube superhet design, which assures plenty of pickup and volume. The layout shown is for a 10" skillet; a smaller one may cause a little trouble. The pan can be old or new, aluminum, cast iron, or copper.

Making the Templates

After choosing your skillet, cut a cardboard template for the chassis. Determine its size by a cut-and-try process, but make one edge flat and the other semicircular. Bend a shelf for the tubes along the flat edge. The skillet shown is 2¼" deep, so the ledge was made 2" wide. On the semicircular edge, cut and bend two 1½" by 1¾" mounting brackets for the tuning condenser (C1) and volume control (R7). Place them so that the shafts will protrude slightly through clearance holes that are drilled for them along the lower side of the pan.

Snip out a second cardboard template for the speaker mounting board and clip it to the back of the chassis template. Spread your parts out on the cardboard then to make sure you have room for all of them (if you're not careful the speaker and the tubes may get in each other's way).

When you have the chassis and major parts arranged to fit, trace off the templates. The chassis can be cut from a 6" by 9" sheet of aluminum; the speaker board from a 6" by 10" piece of plywood, plastic, or composition board. Mounting holes are needed for the miniature tube sockets, IF transformers, tuning condenser, volume control, and other large parts.



Parts layout must be planned before work begins if the set is to fit snugly in a skillet.

A common characteristic of AC-DC receivers is a "hot" chassis, since one side of the power line is connected directly to ground. When the wall plug is inserted one way, there is a potential of 115 volts between the chassis and an external ground such as a water faucet or pipe. This could be dangerous, so it's essential that you isolate the chassis from ground.

Note in the diagram that a common wire lead is used as a "floating" ground. This ground point is connected to the chassis at a few places through condensers and a resistor; it must never touch the chassis directly. Some additional circuit stability is obtained by connecting the ground and chassis together in this fashion, and the voltages that reach the chassis are too low to be dangerous.

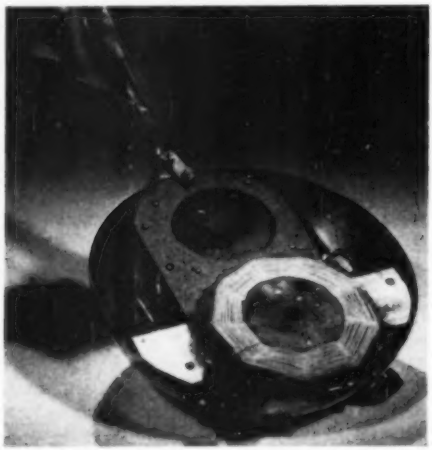
For additional protection, line the skillet with tape at any place where the chassis may touch it directly. Make sure, also, that the control shafts don't rub against the edge of the pan.

Two Controls Do the Job

Only two controls are needed. The SPST power switch, S1, is mounted on the back of the volume control, R7. The other control belongs to the midget two-gang tuning condenser, C1. One section of this condenser tunes the antenna coil or loop, the other the oscillator. The oscillator section of the con-

Cut and drill the chassis and assemble the major parts before wiring. Note flaps in the lower edge for volume and tuning controls.

Set the loop antenna away from the back of speaker board to space the speaker off the wall and let the sound come out clearly.



To hold the set in the pan, use a flat bracket at top and a right-angle bracket at bottom. Chassis should not touch the pan.

denser has fewer and smaller plates than the antenna half. Try to buy a condenser with built-in trimmers for final adjustment.

The signal picked up by the antenna is tuned and amplified by the 12BE6 oscillator-mixer tube. The oscillator coil mounted next to the tuning condenser must be clear of the skillet when the set is assembled. When you buy the coil, be sure to specify the type with a single winding and center-tap. You don't want a coil that has two separate windings and four connections.

Choose Miniature Parts

Use miniature parts as much as possible. The paper condensers in this set are the new midget tubulars; resistors, too, are being made smaller than they used to be. Should you have trouble locating a .2-mfd., 400-volt condenser (C3), you can use two .1-mfd. capacitors in parallel. That was done in this set. Hence, the label C3 points to two units in the photo on page 243.

Any frequency that is tuned in is converted by the oscillator-mixer to a fixed frequency of 455 kc. This is amplified again by the 12BA6 IF amplifier and fed to the diode portion of the 12AT6 detector-first audio tube. There it is changed into an audio-frequency signal and amplified some more. It then goes to the 50B5 output tube where it is built up to loudspeaker volume.

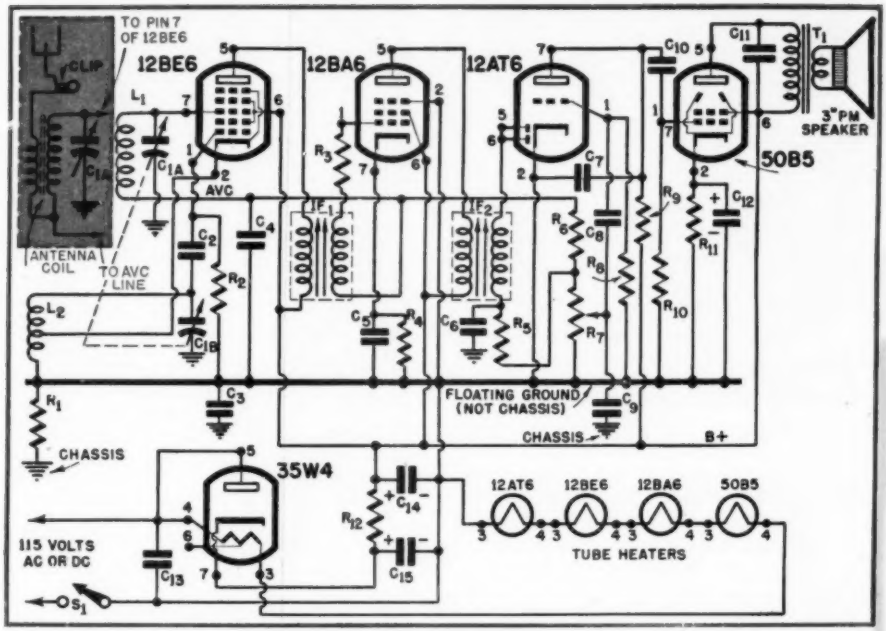
A transformer in the plate circuit of the output tube matches the impedance of the tube (about 2,500 ohms) to the voice coil of the speaker (3 to 8 ohms, depending on the make). To be sure of getting a good match, you can use a universal output transformer that has several taps from which you can choose the best combination.

To cut out shrill tones, a by-pass condenser (C11) is wired between the plate and screen grid of the 50B5. If it makes the wiring easier you can connect this condenser from plate to ground instead.

Controls at an Angle

In the construction shown, the control shafts go outward at an angle. Hence, the holes in the skillet are oversize; they should be, anyhow, to prevent electrical contact between the shaft and the metal of the pan. The holes are covered on the outside by dial plates.

The speaker and output transformer are attached to the insulating panel that is bolted to the chassis. Use the back of the same panel for mounting the loop antenna. Space



LIST OF PARTS

All resistors ½-watt carbon unless otherwise specified.
R1, R2, R5: 22,000 ohms.
R3: 1,800 ohms.
R4: 470 ohms.
R6: 2.2 meg.
R7: 500,000-ohm pot. with switch.
R8: 3.3 meg.
R9: 220,000 ohms.
R10: 470,000 ohms.
R11: 150-ohm, 1-watt carbon.
R12: 1,200-ohm, 2-watt carbon.
C1A, B: Two-gang midget tuning condenser with cut-plate oscillator
C2: 50-mmf. mica.
C3: .2-mfd., 400-volt paper (see text).
C4, C5, C13: .05-mfd., 400-volt paper.
C6, C9: 300-mmf. mica.
C7: 220-mmf. mica.
C8: .006-mfd. mica.
C10, C11: .01-mfd., 400-volt paper.
C12: 10-mfd., 25-volt electrolytic.
C14, C15: 50-mfd., 150-volt electrolytic.
L1: Loop antenna or antenna coil for broadcast band (see text).
L2: Center-tapped oscillator coil for 455 kc. IF.
IF1, IF2: Midget iron-core intermediate-frequency trans.
T1: Universal output transformer.
S1: SPST switch on R7.
Tubes, miniature wafer sockets, 3" PM speaker, misc. hardware.

the loop off the panel with metal clips as shown in the photos.

Tube heaters are wired in series and are detailed separately in the lower right-hand part of the diagram. Since the rating of all tubes together is something over 121 volts, no dropping resistor is needed to operate them directly off the line. Wire them in the sequence shown.

Final Adjustments

When the wiring is complete, you may have to sharpen the alignment a trifle. Tune in a strong local station. Adjust the trimmers on the IF transformers to obtain the greatest volume possible. If the set gets too loud, turn down the volume control. Next, touch up the trimmer across the oscillator section of the tuning condenser. Tune in a station at the high end of the broadcast band (with the plates out of the mesh) and adjust the oscillator trimmer until the station comes in at the correct dial setting. Finally, adjust the trimmer on the antenna section of C1 until stations are received at maximum signal strength.

P.S. How about giving your wife a new pan and using her old one for this project?

END

The Weight of Light

THE weight or mass of light has been shown by Dr. Einstein in his studies of other forms of energy. It is based on the fact that light coming from a distant star is pulled inward as it passes close to the sun. Calculations show that, during every second, the total mass of light and other radiation from the sun amounts to 4,620,000 tons. One percent of this amount will be used up in 150,000,000,000 years.

Pencil Adjusts Needle Point

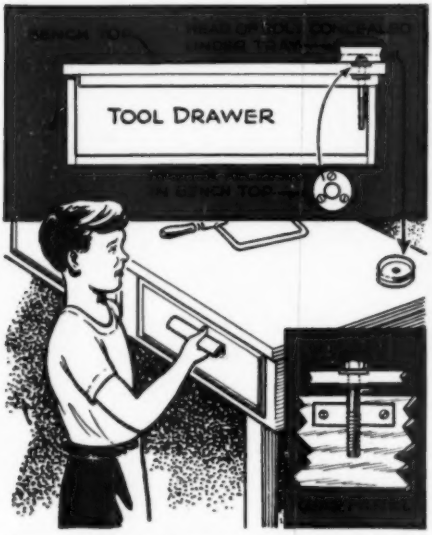
To PIERCE tiny holes to accurate depths in wood, leather, and similar materials, just replace the lead in an ordinary mechanical pencil with a sewing needle. Then you can easily adjust the length of the point.—*Henry S. Galus, New Bedford, Mass.*

Ice Aids Pile Driving

HERE'S a neat trick for driving piles for a boat house or dock—and you don't have to wait until spring to start work. When there's a good freeze on the lake, simply chop holes in the ice where you want the piles to go and drive them through to the bottom, as shown below. The ice will hold the piles a lot better than you can working from a boat. Comes the spring thaw, and there's your piling.—*Leonard O. Timm, Bennington, Neb.*

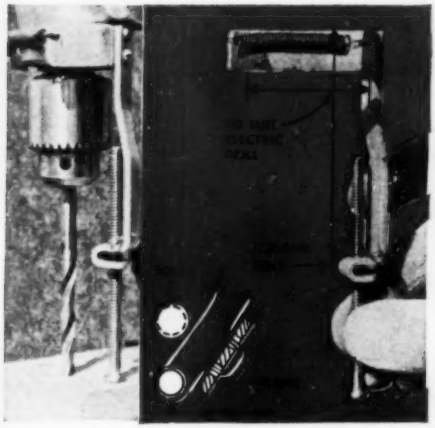
Glass Dinghy Rows or Sails

THIS new, all-glass dinghy may be an answer to the problem of making dinghies light and easy to handle yet strong and durable. Made of four plies of Fiberglas® impregnated with plastic, the six-foot-long, experimental craft was built by Sid Hall, California boat designer, aboard his small barge workshop at Sausalito. Molded in one piece, it is flexible yet tough and has no seams to dry out and open up. Its light weight—only 30 pounds—and covered foredeck allow it to be launched from considerable height without swamping (top photo). A long, shallow keel, rudder, and mast support permit a quick change for sailing.



Secret Bolt Locks Up Tools

HERE's a simple trick for keeping inquisitive youngsters out of your tool drawers. Drill a hole through the bench top so it lines up just inside the back of the drawer. Reinforce the hole with washers and the drawer back with a plate as shown. Then drop a ½" bolt down the hole and cover the head with an innocent-looking tray or jar cap.—*Charles H. Hardy, Los Angeles, Calif.*

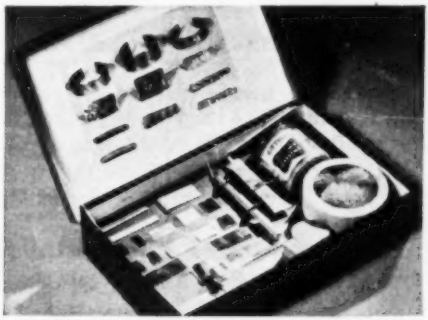


Gauge Sets Drill Depth

NO CHANCE of drilling too deep or too shallow if you make this simple depth gauge for your hand drill. All it consists of is a 3" bolt held in a frame alongside the drill. By adjusting the length of the bolt, you can easily set the depth of the drill cut. Bend the two frame parts out of strips of brass, aluminum, or steel, and screw or solder together. A spring across the top clips the frame to the drill. A safety pin wedged in between the bolt and the frame keeps vibration from moving the bolt once it's set.—*Robert Hoppough, Waukegan, Ill.*

Slag Stops Highway Skids

MADE by crushing slag to the size of fine gravel, this special grit is said to give better traction on snow or ice than sand or ashes. It does not absorb moisture and remains free-flowing at low temperatures. The J. P. Loomis Coal & Supply Co., Akron, O., puts it up in bags for use in mechanical sanders and in containers for carrying in car trunks.

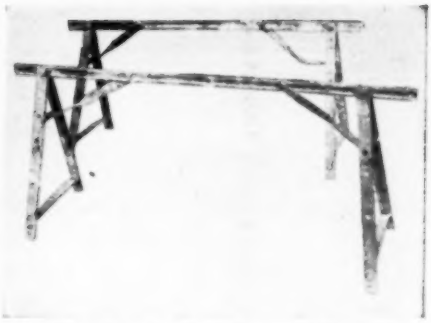


Etching Done Without Acid

WITH this new kit, you can etch metal without using dangerous acid. It contains an etching agent so harmless that even children are said to be able to use it safely. You also get sample designs and a special knife for cutting your own designs in the tape that serves as a mask. Handmade by Hilary, New York, offers the kit for about $5.

Paul Bunyan Could Use This

EVERY few years this massive earth ripper is used for deep plowing in California's Imperial Valley to maintain productivity of the topsoil. Constructed on a Paul Bunyan scale, the moldboard is 6′ high and 9′ long. *—Robert Daily, Long Beach, Calif.*



Scrap Used for Steel Horses

SHOVEL beams from an old corn cultivator form the main parts of these sturdy steel sawhorses that were welded up in the shop of the John J. Fitzpatrick farm near New London, Iowa. Other pieces from the scrap pile were used for the cross and angle braces.

Wooden Cab Built on Tractor

YEAR-ROUND weather protection is afforded by this tractor cab built of plywood and 1″ lumber. The hinged windows can be opened from inside the cab by draw cords. On rainy days, a canvas curtain closes the rear.*—Willis Hinkson, Mt. Pleasant, Ia.*

Chews Leaves, Spits Dust

THIS attachment for the Mow-Master® rotary mower pulverizes leaves so finely that the particles scatter between the blades of grass like dust, leaving the lawn clean. This does away with the task of raking and burning leaves. The Propulsion Engine Corp., of Kansas City, the maker, claims that the attachment returns the mineral-rich contents of the leaves to the soil, providing plant food. The Mow-Master, powered by a 2-hp. engine, has both an automatic governor and a manual control.

Steel Bar Makes Pipe Puller

THIS steel-bar pipe puller has a ring slightly larger than the pipe to be drawn up. Made from square stock, the ring edge bites the pipe with its straight edges. When the rope is slacked, the tool takes a new hold.*—A. M. Wettach, Mt. Pleasant, Ia.*

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Ray·O·Vac LEAK PROOF batteries stay fresh for years!

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Buy Spares... *they stay fresh*

Hangers Fold for Traveling

THESE folding hangers, molded of Monsanto's Lustron® plastic, will fit into your suitcase for traveling or may be stored out of the way if your closet gets too crowded. They are designed to fit both women's and men's clothing. Priced at $1.00 for three, the folding hangers are sold by Kingly Plastic Products Corp., New York City.

Kitchen Fits 60-Inch Space

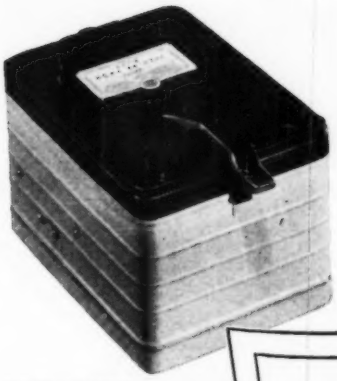
This GE kitchen squeezes stove, refrigerator, sink and storage cabinets into a unit 60 inches wide, 84 inches high, and 25 inches deep. The stove has three five-heat burners plus full-sized oven and broiler. The four-cu.-ft. refrigerator can freeze four pounds of ice cubes, has chiller tray for meat. The 39-in. sink has space for garbage disposer.

Spats Keep Off Spots

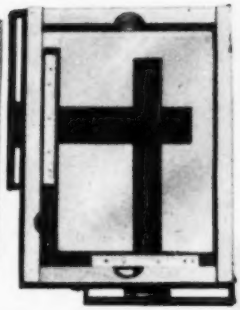
YOUR womenfolk won't have to worry about mud-spattered stockings if they wear these plastic spats that zip over their ankles in rainy weather. Glamour Spats® come in all colors, have a neat container that slips over the handle of an umbrella, and fit all types of shoes. Made by Wheaton Weather Wear, Detroit, they sell for about $2.50.

Mat for Rubbers Saves Floors

THERE'LL be a welcome on the door mat the next rainy day if you use the new Rubber Roosts® to park your rubbers or boots. They are made of brown or green rubber with raised sides to protect the floor and deep corrugations to speed evaporation. Rubber Roost, St. Paul, Minn. makes them to sell for $1.35.



Kodak Home Printer—One-piece top automatically works light. Accepts negatives up to 4 x 5½ inches. Strip-prints 35mm. and larger roll-film negatives. Price, $12.50.



Kodak Auto-Mask Printing Frame—Clip holds negative firmly. Graduated scales on two sides also serve as paper guides. Price, $3.25.

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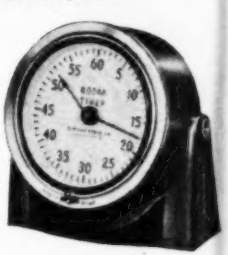
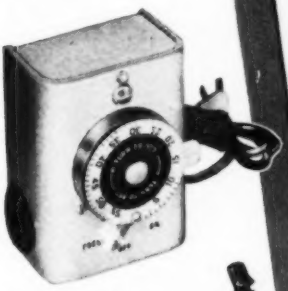
for your darkroom

Prints for your albums . . . extra prints for your friends . . . Kodak equipment makes home printing easy. Inspect these contact-printing aids at your Kodak dealer's.

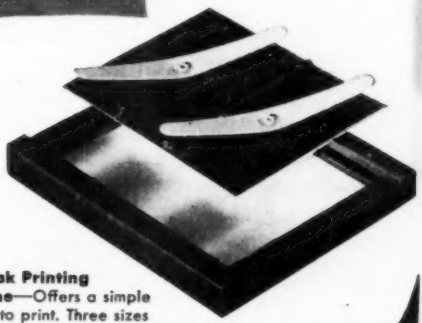


Kodak Timer with Tilting Base—Has both minute and split-second hands. Switch permits stopping timer and then restarting it without resetting hands. Easy reading in dim light. Price, $7.50.



Kodak Electric Time Control—Plugs into printer or enlarger. 1 to 57 seconds. Repeat timing requires only original setting and turn of dial for each printing. Price, $13.50.

Kodak All-Metal Printer—For negatives up to 4 x 5 inches and paper through 5 x 7 inches. Illuminated masking scales; center masking; guide for lining up paper; 35mm. guides for strip-printing; negative-locking device. Price, $22.50.



Kodak Printing Frame—Offers a simple way to print. Three sizes available: 3¼ x 5½, 4 x 5, 5 x 7 inches. Supplied with a glass front—you use ordinary house lamp for light source. Price, from $1.25.

Prices include Federal Tax where applicable

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Atlas DRILL PRESSES

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Four ball bearings in the head give you a "floating drive" that is smoother and dependably accurate for years. The new depth stop is more convenient, and the heavier construction adds to smoothness and accuracy on heavy drilling in metal or high speed work on wood.

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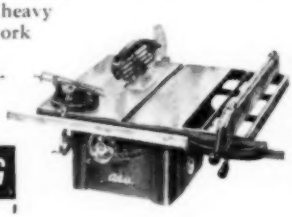
Three sizes are available. 12¾" bench model, and 15" in bench or floor models. Send the coupon today — see all of the exclusive and special features of the Atlas — before you select the drill for your shop this year.



Atlas 8" TILT/ARBOR SAW

Draw an area 26¾" x 22" (table size of this saw, as shown) and you'll quickly see why it's the most popular low-cost circular saw on the market. Use the coupon for latest catalog with full details.

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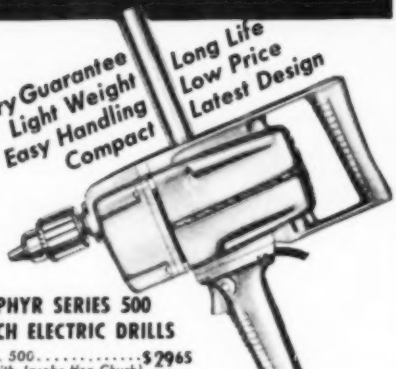

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½-INCH ELECTRIC DRILLS

Model No. 500 ..... $29.65
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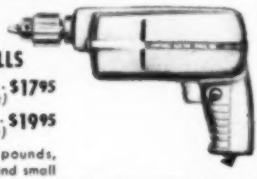
Model No. 510 ..... $34.65
(with Jacobs Gear Chuck)

Full ½-inch drill capacity; removable side handle for close-quarter drilling; weight complete only 9 pounds. U. L. listed.



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Weight complete, only 3 pounds, 2 ounces. The speed, power, and small size make it the ideal power tool; handy to use as source of power for driving drill attachments for disc sanding and polishing, cleaning paint brushes, grinding and sharpening tools, buffing, removing rust and paint with wire wheel brushes, etc. A real money saver around the house, farm and home shop. U. L. listed.

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Everywhere you go, experienced motorcyclists say this is the finest Harley-Davidson of them all! They acclaim its surging new power, its rocket-like acceleration, its easy steering, positive braking, ground-gripper stability and its amazing float-along comfort that lets you ride all day without tiring! You'll enjoy the outdoors as never before, as you take in thrilling race meets, hillclimbs, gypsy tours and sightseeing trips. And you'll agree, there's no sport like motorcycling, no fun like owning a Harley-Davidson! One ride will convince you. Small down payment and easy terms . . . and "you're in!" See your dealer without delay. Mail the coupon now.

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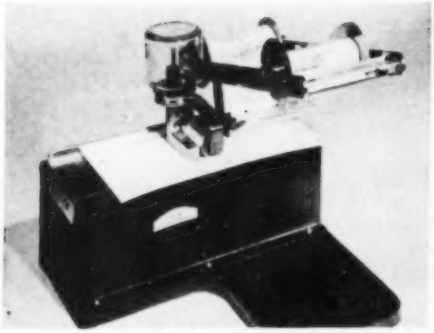

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THIS machine prints addresses on envelopes from a paper tape that can be used 100 times. The tape, backed by special carbon paper, is first typed, then mounted on the addresser, carbon side down. When an envelope is placed on the machine, a roller coats its face with invisible printing fluid. The tape is then pressed against the envelope, and its carbon impression imprints the address on the treated surface. The Weber Addressing Machine Co., of Mt. Prospect, Ill., makes the device.

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A STOREKEEPER can change an advertising message in a matter of seconds with this new display sign that has interchangeable neon letters. The letters in the sign plug like radio tubes into sockets, which are mounted on a double-tiered platform. Available in five colors, they consist of all the letters in the alphabet, numerals, dollar and cent signs, and punctuation marks. The display, which plugs into any 110-volt AC circuit, is made by the Neco Manufacturing Company, Inc., of Auburn, Ind.

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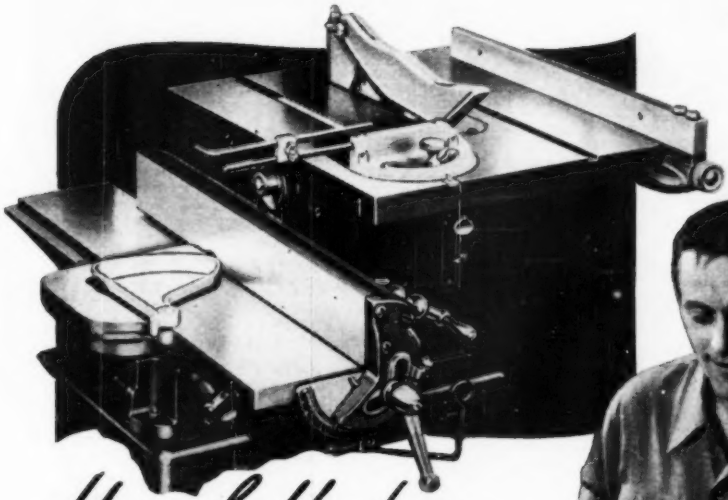

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New Delta® Homecraft Saw-Jointer

Low-cost combination unit does most home-shop jobs

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This new combination takes floor space of only 25¼" x 28¼". Husky 8" tilting-table circular saw cuts stock up to 2¼" thick on large 15" x 18" table. Jointer planes wood 4" wide and cuts rabbets ¼" deep. Fence tilts 45° to right or left.

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See this new Delta Homecraft Saw-Jointer today at your nearest dealer. If you don't know who he is, send us coupon below for his name and address — and your free copy of shop-planning book.

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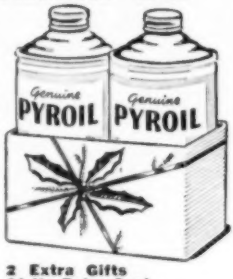

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Connecting drives, socket openings and ratchet parts are precision machined.

This smart set comes in a handsome chrome-plated metal box with beautiful red flock lining. All wrenches and sockets are chrome-plated.

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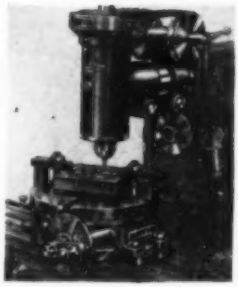
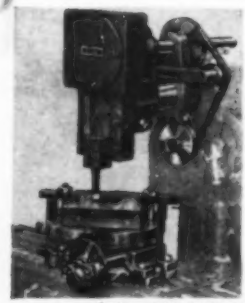


With the MARVIN VERTICAL MILL ATTACHMENT you can do *profile milling* . . . produce cams and clutches . . . intricate molds and dies. It can be set at angles and pulled far beyond table travel for large overhanging work. Price $65.00 F.O.B. Factory.



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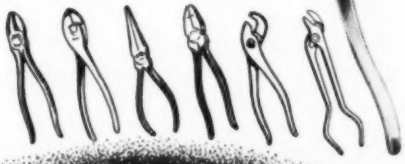

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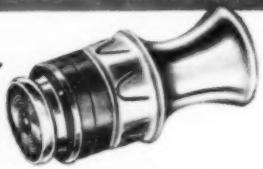

Why do without your lost or broken lighter? It's easy and inexpensive to replace it with a new, chrome-plated Casco "Pop-Out" . . . original equipment in 9 out of 10 cars. Pops out *automatically* in 10 seconds with a nice, even glow. Blends beautifully with any dashboard. Now at Car Dealers, Auto Supply Stores, Garages, Service Stations..... **$1.50**

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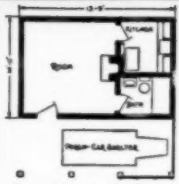

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The McCulloch gasoline-powered portable saw cuts like fury through any kind of tree or timber—and weighs less than 25 lbs. You can take it anywhere without effort: up hills, through brush, across wet or snow-covered ground, or up in a tree. Wood-cutting was once hard work; it's much easier and far faster with a McCulloch.

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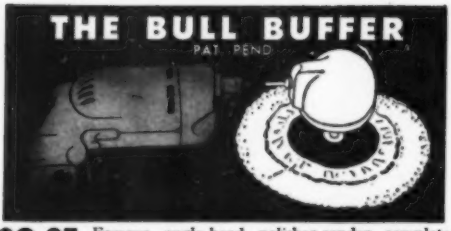

$9.95 Famous angle-head polisher-sander complete with sheepskin bonnet and 2 sanding discs. Fits the chuck of any ¼ inch electric drill. A heavy-duty, rugged tool you'll use to make your car, floors, woodwork, furniture gleam like new! It's America's First Choice—more than 100,000 in daily use. Order today!

ORDER THESE ACCESSORIES FOR YOUR BULL BUFFER

(For use with Bull Buffer only)

5¾" finest quality bark tan sheepskin bonnet, **$1.25.** 5" aluminum oxide production sanding discs (0000-00-0-1-2½-3), **$.10** each. #4 open grit, **$.15** each.

½" Jacobs Hex key chuck. When attached to the Bull Buffer, gives you angle-head drilling attachment. Increases ¼" drill to ½" capacity, provides power for heavy drilling in wood or steel. **$5.00.** 2½" cup wire brush. Easily attached to Bull Buffer angle-head. Removes paint, rust, scale, etc. **Right now! $1.75.**

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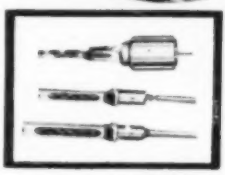
Now you can mortise **on-the-job,** now you can rout **on-the-spot** with the new Bull Mortising Adapter! This amazing new adapter can be attached in either drill or drill press in a matter of seconds, and it gives you a powerful, **portable** tool that really makes the chips fly!

NOTE: Bull Mortising Adapter is designed specifically for use in any ¼" electric drill or any drill press; it should **not** be used with ⅜" or ½" electric drills.



BULL MORTISING KIT

Includes Bull Mortising Adapter and ¼", ⅜", and ½" chisels with corresponding bits. Complete, guaranteed, only..... **$23.90**

MORTISING ADAPTER ONLY

Fits any ¼" electric drill or drill press; also fits any standard mortising bit and chisel..... **$6.95**

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Engrave my name (75c extra). Please print clearly.

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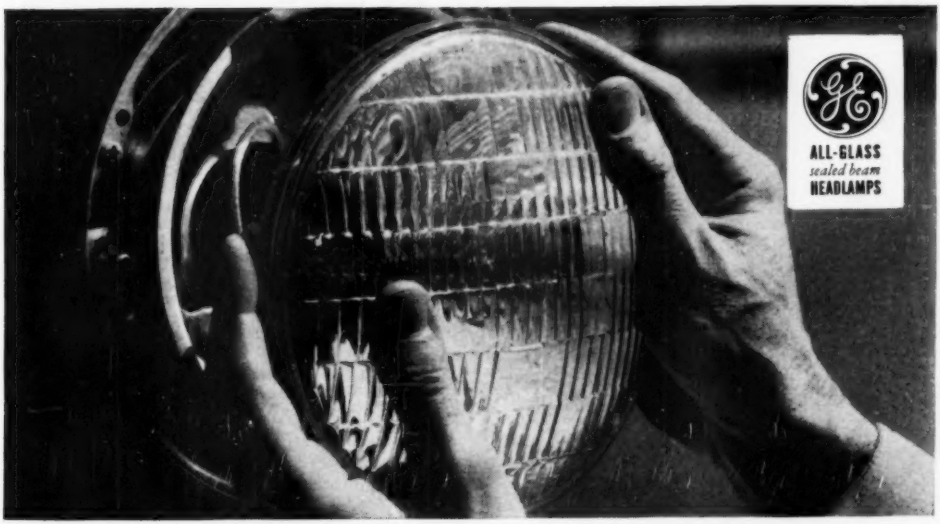
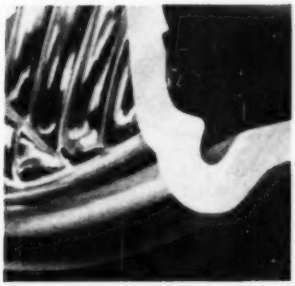
How easy can night driving be?
Get General Electric headlamps and see!

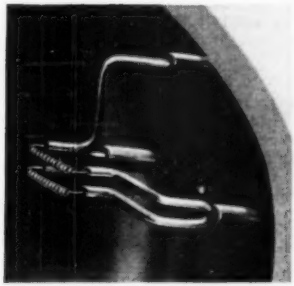


...they do not grow dim!

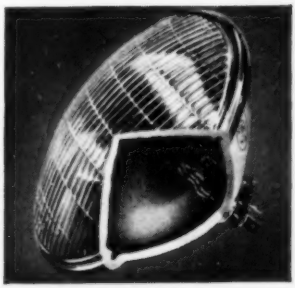
1. NIGHT DRIVING is easier with General Electric "all-glass" sealed beam headlamps because they average 99% of original light output at end of life. *They do not grow dim!*



2. DIRT AND MOISTURE can't get in to steal the light—due to the rugged, "all-glass", one-piece construction of G-E sealed beam headlamps.



3. FILAMENTS are held in vise-like grip. Won't shake loose on bumpy roads. Give 12% more light on the road for driving, 16% more light for passing.



4. HARD-GLASS LENS is precision-made to throw maximum light on road. Have lights checked when car is serviced—and insist on G-E for replacement!

You can put your confidence in—

GENERAL ELECTRIC

ONLY $199.50 FOR A COMPLETE POWER WORKSHOP

Your complete power workshop in just 18" x 60" floor space. With ½-hp. ball-bearing motor illustrated, $199.50.

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For less than $200—and with eight square feet of floor space—you can have a power shop second to none in capacity, accuracy and flexibility. It's Shopsmith—five heavy-duty, extra-feature tools in one unit so beautifully engineered, so ingeniously designed that you can convert from tool to tool *in less than 60 seconds.*

NEVER BEFORE SUCH AMAZING CAPACITY

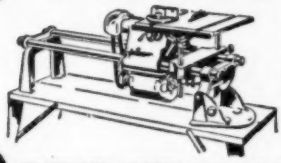
Imagine a circular saw that cuts to center of 8' plywood panels . . . a lathe that takes work up to 15 inches in diameter . . . a drill press that mortises doors and panels as easily as it drills miniature parts . . . a disc sander that squares, miters and finishes with "try square" accuracy. You get these, and more, with Shopsmith.

OUTPERFORMS SINGLE-PURPOSE TOOLS

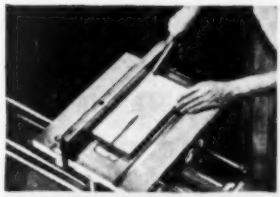
Compare Shopsmith with any combination of single tools at any price. Compare it for accuracy, capacity, all-round utility. You'll see why the thousands of men who own Shopsmith praise it so enthusiastically. On display at any Montgomery Ward store and at leading hardware or department stores. Shopsmith, complete with attachments, costs $169.50. With heavy-duty ½-hp. ball-bearing motor, $199.50.

5 RUGGED POWER TOOLS IN 1

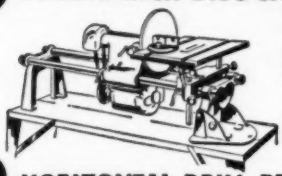
1 EIGHT-INCH CIRCULAR SAW



Effective table width up to 56". Maximum depth of cut, 2¼". Machined tilting table, ribbed for extra strength. Precision-tooled rip fence and miter gauge. Unique micro-adjustment permits extremely accurate ripping.

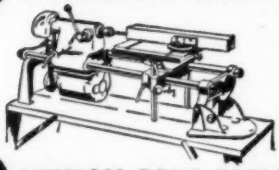


2 TWELVE-INCH DISC SANDER

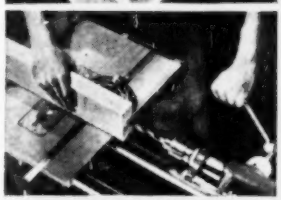


Cast-aluminum disc easy to attach and remove. Extra-large, adjustable table measures 14½" x 17". Miter gauge and rip fence can be used for accurate squaring and jointing. Has features found in no other disc sander.

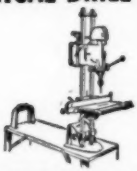
3 HORIZONTAL DRILL PRESS



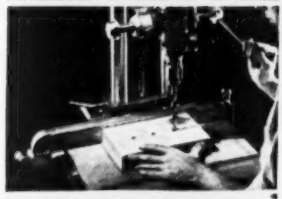
Extremely useful operation possible only with SHOPSMITH. 4" quill feed, automatic stops. Permits large, heavy pieces to be drilled or mortised quickly and accurately. Eliminates need for jigs. Length of work limited only by size of room.



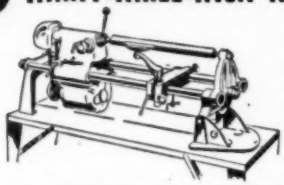
4 VERTICAL DRILL PRESS



SHOPSMITH drills to the center of a 15" circle, has a maximum clearance table to chuck of 27". Jacobs key chuck takes drills from 5/64" to ½" diameter. Rugged, six-spline spindle with 4" feed. Variable speeds 875 to 3500 rpm.



5 THIRTY-THREE-INCH WOOD LATHE



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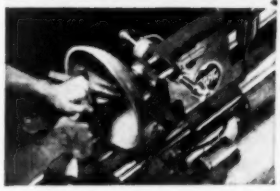

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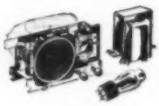

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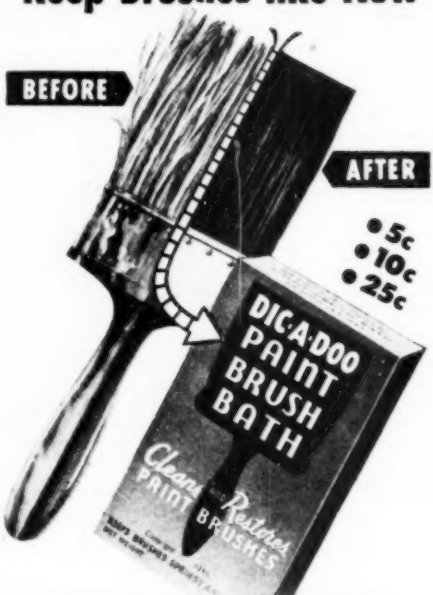

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Solid frame; 9 shot; shoots long rifle, long, or short regular or high speed ammunition, both single and double action; 6", 4", or 2½" barrels; checkered Tenite stock.

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Same as model "922" except all metal parts are of chrome finish. $26.78

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Modern—streamlined—fits the hand like a fountain pen! Easy to use as a pencil. Draws parallel lines—straight, curve, or circular. Does expert job on autos, furniture, toys, bikes, model planes, signs, bulletins, linoleum. (Makes wall board look like tile.) Every painter and craftsman needs one! Type "M" MASTER Painters' Striping Tool complete with tip for 1/16" stripe, $1.00. Other tools complete with following tips 1/64", 1/32", 3/64", 5/64", 3/32", 1/8", $1.50 ea. Extra tips 75c ea. Entire kit with tool and 7 tips, $5.00. (COD's postage collect) Paint dealers, write!

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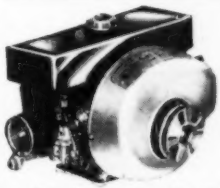

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Brand new, complete with air filter, magneto, gas tank, Tillotson float feed carburetor, accurate speed governor.
Pulley shaft ⅝" diameter. Speed range 2700 to 3800 R.P.M. Suitable for use on pumps, air compressors, power tools, portable generators, light scooters.

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Shipped transportation charges collect. Send postal or express money order with order.

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Ideal For: • Home Lighting • Hunting Lodges • Stand-by electricity • Running all AC electrical appliances incl. fans, motors, electric razors, refrigerators, incubators, etc.

Protection for emergencies to operate oil burner, stoker, freezer, water pump and lights. These units built to exacting Signal Corps specifications are the answer to your lighting needs. Drive it with a 2½ H.P. gasoline engine at 1800 R.P.M.

• 800 watts • 0-150 voltmeter with regulator • 110 volts-60 cycle, AC. Ship. wt. 60 lbs.

AN OUTSTANDING VALUE for ..... $59.50 F.O.B. Chicago (Item #67)

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HALE FIRE and IRRIGATION

High Volume

CENTRIFUGAL PUMP

For Fire Protection, Irrigation, De-Watering, Industrial Uses, Farm Uses, Etc.

Pumps Rated 500 Gallons Per Minute at 275 Ft. Head Pressure

Equipped with 1½" diameter straight splined shaft for direct coupling drive; 4½" threaded suction intake; two—2½" threaded discharge outlets; Hale Pump Co. Model CF volute type; use any 4 or 6 cylinder gas engine or couple directly to front of truck or auto; or use 25 H.P. electric motor; dimensions 21" x 24" x 28". Complete with full accessory kit including suction and pressure gauges, priming equipment, and instruction book. Ship. wt. 415 lbs.

NOW $149.50

GOV'T ACQUISITION COST $425.00 (ITEM #48) F.O.B. Chicago

WATEROUS PUMP (Item #71)

Rated 500 GPM at 120 P.S.I.

This high efficiency pump is designed for front end mounting on General Motors, Dodge and Ford trucks. Comes complete with gear box for speed step-up; easily mounted for drive from crank shaft. Net wt. 500 lbs. Ship. wt. 1200 lbs. A REAL BUY....

$149.50 F.O.B. Chicago

CENTRIFUGAL PUMP

BELT DRIVEN READY FOR USE ON ANY LIQUID PUMPING NEED

A super value for all types of intermittent service in pumping large volumes of liquid in home, farm and industrial service. Ideal for home water systems, draining basements, fire protection, etc. On the farm for watering stock, draining ponds, sprinkling, etc. In shops and factories for all types of pumping service.

Brand New

Use it for Draining Basements • Home Water Systems • Irrigation • Stock Watering • Fire Protection • Draining Ponds, Tanks, etc. • Industrial Pumping

MOVE LARGE VOLUME QUICKLY. When operated at 1750 RPM, will pump 42 gallons per minute on a 23 foot head; at 3600 RPM on 52 foot head will pump 88 gallons per minute. May be run with electric motor, gas engine or power take-off on tractor.

COMPLETE ENGINEERING REPORTS AND OPERATING INSTRUCTIONS FREE WITH PUMP

Pump has cast aluminum housing—accurately machined bronze impeller vanes. Complete with mounting bracket and 3½" V belt pulley. Shaft rotates on sealed ball bearings with grease gun fitting. Has 1½" threaded intake flange, two 1 inch outlets. Use one or both, as necessary. Made for Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft engines.

Greatest Pump Value in Years

You can't beat this value at anywhere near this price. Satisfaction guaranteed. Shipping weight 23 lbs.

Original Cost Approx. $147.00. (Item #64) F.O.B. Chicago

Complete with Pulley and Mounting Bracket — Ready for Use. $29.75

Self-Priming

ELECTRIC PUMP

Compact—Brand New

APPLICATIONS: oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc.

MOTOR MFD. BY BLACK & DECKER: double ball bearing series wound, continuous duty, 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC.

PUMP MFD by WELDON TOOL CO. with standard ¼" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder.

OVERALL DIMENSIONS: 7¾" long x 3¼" wide x 3¼" high. Approx. wt. 5 lbs. $51.00 value. (Item #1)

$12.95 postpaid

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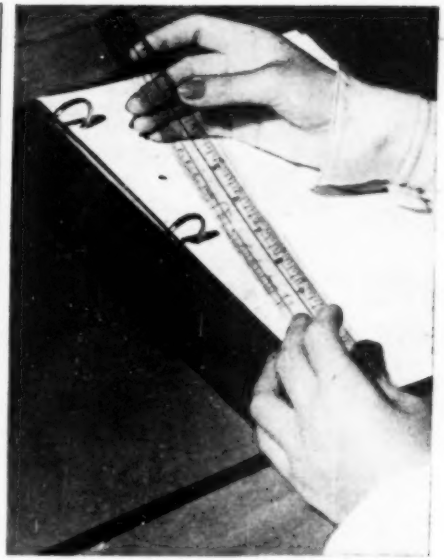

Ruler Hugs Notebook Rings

CUTOUTS that fit around the closed rings of a notebook keep this Vinylite® ruler from dropping out; yet it is easily inserted or removed. Made by Plastilite Products Co., of Pawtucket, R. I., it is suitable for both pencil and ink rulings on flat or curved surfaces.

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SLIPPING Junior's bottle into this washable travel case will keep his refreshment either hot or cool several hours—thanks to the insulation with which it is padded. At feeding time the bottle can be propped up in the holder attached to the case. The Thermotainer® is made by Fashioncraft Cloth Products, Inc., of Brooklyn, N. Y.

All Merchandise Brand New - Order Today - Satisfaction Guaranteed!

HANNA AIR CYLINDER

Brand New

Used for heavy duty industrial applications on shop air lines or with low pressure systems. With 100 lbs. of air pressure, will deliver 1900 lbs. pressure at the ram shaft. All steel construction. Adjustable cushions at both ends of cylinder. Shaft dia. 1½". Foot mounting with clevis on ram shaft. 26½" double-acting stroke; 5" bore, 40½" overall length closed. 7" overall width. 89½ lbs. net wt. Gov't. acq. cost $101.85.

(Item #61) AN EXCELLENT VALUE for — — $39.50 F.O.B. Chicago

Hydraulic Cylinders-Air or Oil

Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, lift or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship. BRAND NEW.

ITEM #4—Double action, 1" bore, 3" stroke, will lift 770 lbs. in 1/10 of a second using Logan Pump. All steel barrel. Ideal for controls, door openers, positioning, etc. An $18.00 value . . . . . postpaid **$4.95**

ITEM #32—Double action, 1½" bore, 9" stroke, will lift 1760 lbs. in one second with Logan Pump. Wt. 4 lbs. A $45.00 value . . . . . postpaid **$10.95**

ITEM #16—Use these cylinders on farm trucks, buildozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 8 lbs. A $55.00 hydraulic cylinder value for only . . . . . postpaid **$12.95**

ITEM #17—Double action, 2¾" bore, 8" stroke. (Will lift 4400 lbs. in one second with Logan Pump.) Will withstand 1500 P.S.I. against wall. Wt. 7 lbs. A $65.00 value . . . . . Postpaid **$14.50**

ITEM #20—Double action, 2¾" bore, 4" stroke, two-way solid ⅝" alloy steel shaft (will lift 4400 lbs. in one second with Logan Pump). A $73.00 value at . . . . . postpaid **$16.50**

ITEM #15—Double action, 3" bore, 8½" stroke. All steel hydraulic cylinder, will lift up to 12,000 lbs. (7000 lbs. in 3 seconds with Logan Pump). Complete with fittings. Wt. 12 lbs. A $78.00 value . . . . . postpaid **$19.50**

ITEM #31—Double action, 3½" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Complete with fittings. Wt. 15 lbs. A $92.00 value . . . . . postpaid **$22.50**

ITEM #6—Double action, 3" bore, 23" stroke, hydraulic cylinder will lift 7070 lbs. in 5½ seconds using Logan Hydraulic Pump. Especially suited for farm and construction machinery. Clevis mounting for easy use. Wt. 22 lbs. A $145.00 value . . . . . F.O.B. Chicago **$27.50**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 los. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for . . . . . F.O.B. Chicago **$32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅜" pipe and 50c ea. for ½" pipe.

LOGAN 4-Way Foot Operated

AIR VALVE

Model 6520

BRAND NEW. For double-acting pneumatic devices. Fine for operating air vises, presses, air machinery of many types. Heavy cast construction. Threaded for ½" pipe. Dimensions of valve body: 8½"L x 5¾"W x 7½"H. Net Wt. 28 lbs. Gov't acquisition cost $42.00. AN OUTSTANDING BUY AT $15.00

(ITEM #59) F.O.B. Chicago

NOW . . . It's Easy to Weld with this handy

ELECTRIC ARC WELDER

Designed for many years of trouble-free service! Handles anything from light gauge sheet metal to ½" plate.

This precision-engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it.

The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16 to 3/16" rods. Run welder at 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use one or two V-belts, or flat belts (on pulley). Continuous welding rating—250 amps.; intermittent rating—250 amps.; 0-40 volts. Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 95 lbs. Only one or two jobs will pay for entire welder. **$99.50**

(Item #65) F.O.B. Chicago

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. **$10.50**

(Item #66) F.O.B. Chicago

Remember, Satisfaction is Guaranteed

G-1 Stainless Tank

Use these tanks on compressors, for tire inflators, pulsation chambers, floats, buoys, hydraulic reservoirs, fluid and milk containers, fuel containers, etc. Tough, light, 450 lbs. P.S.I. Aviators Breathing Oxygen bottles. Type G-1. 2100 cu. in. (approx. 9 gallons) int. vol. 24" x 12". ¼" threaded openings at ea. end. Wt. 19 lbs. (.51" thick.

(ITEM #63) F.O.B. Chicago **$4.95**

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Write for free copy of our 40 page catalog including Hydraulic Manual featuring diagrams, photographs and instructions. Catalog lists excellent war surplus values: pumps, valves, hydraulics, lights, motors, etc.

Vickers MF9 Hydraulic

PUMP or MOTOR

complete with mounting kit ready to install

$19.90 postpaid

$75.00 value

Pump is compact, powerful, rated 1,000 P.S.I., .507 cu. in. per revolution. 8 gal. per min. at 3750 RPM. Change rotation by reversing flow. Delivers up to 6 H.P. Requires ⅓ to 6 H.P. to drive directly or by pulley. BRAND NEW.

Mounting kit has been especially designed to provide maximum utility and ease of mounting MF Series Vickers Pumps. Brackets are constructed of heavy steel plate; shaft is made of ½" steel with one end splined to fit pump; other end of shaft has machined flat for mounting a standard pulley with ½" hole. Shaft runs in oilite bronze bearings.

(Item #18) Pump only . . . . . $14.95 postpaid
(Item #38) Mounting kit only . . . . . $ 4.95 postpaid
(Item #39) Both as complete unit . . . . . $19.90 postpaid

Hydraulic Control Valves

BRAND NEW

ITEM #24—Four-way control valve for use with double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Brand new. Ship. wt. 4 lbs. A $38.00 value . . . postpaid **$7.95**

ITEM #26—Four-way control valve for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand New. Ship. wt. 6 lbs. A $60 value . . . postpaid **$10.95**

Item #28—A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand New. Ship. wt. 8 lbs. A $75.00 value . . . . . postpaid **$14.95**

VACUUM-AIR GENERAL PURPOSE PUMP

BRAND NEW

Use them for

Oil Burners
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Spraying Machines
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Originally cost $45.00. May be used as air or fluid pump—for pressure or vacuum. Standard ¾" pipe thread with interchangeable ports. Will pump 7½ gal. SAE 30 oil per minute at 300 RPM. Builds air pressure of 30 lbs. per sq. in. at 1000 RPM. Vacuum will draw 26 inches of mercury at 1750 RPM. Develops up to 120 lbs. per sq. in. of hydraulic pressure. Runs forward or reverse. 5¼" x 4¼" x 4". Has stainless alloy steel vanes and impeller. Flat shaft for direct or pulley drive. Recommend a ¼ H.P. or stronger electric motor. Rated capacity 1500 RPM with high overload factor. **Complete illustrated engineering report and instruction book FREE with each pump.** Send check or money order today. WORTH MANY TIMES THIS LOW SALES PRICE **$9.95**

Ship. wt. 10 lbs.

(Item #9) F.O.B. Chicago

LOGAN HEAVY DUTY OIL

Hydraulic Control Valve

BRAND NEW control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, ⅜" pipe thread connections. Overall dimen.: 12½" Hx4½"Dx8"W. Ship. wt. 17 lbs. Govt. Acquisition Cost over $100.00. An Excellent Buy . . . **$21.95**

(Item #37) F.O.B. Chicago

LOGAN HEAVY DUTY OIL

HYDRAULIC PUMP

BRAND NEW . . . for operating hydraulic cylinders and hydraulic motors on tractors, buildozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM at 1000 P.S.I. using 5 H.P. Has ½" pipe thread inlet, ¾" pipe thread outlet, ¾" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5½" H x 5½" W. A $105.00 value. FOR ONLY **$22.50**

F.O.B. Chicago (Item #29)

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Hones all these sharp—hundreds more!

SAFE ELECTRIC JIG SAW

Here's a "Gift" tool that's safe for even small children yet powerful enough to be the most versatile tool in adult workshops! SYNCRO is the safe electric jig saw. Portable. No belts, gears or wheels. Operates on 60 cycle, 110-120 volt AC. Arm adjusts to permit cutting any length ½" wood, ¼" plywood, thin metal and plastic. Not a "lumber cutter" but for delicate, fine craftsmanship. Perfect for family projects or making money. Made and GUARANTEED by the largest company of its kind. Built-in Motor. Complete, ... **$17.50**

NEW SANDER—MASSAGER—POLISHER

You'll love this handy, beautiful, light-weight SYNCRO Electric SANDER-POLISHER! Also gives gentle body massage! 14,400 exclusive "Double Arc" strokes a minute makes sanding or polishing a pleasure instead of a chore! Just guide it. For light sanding, finishing, refinishing, redecorating. Perfect for polishing shoes, furniture, autos, etc. Give or get SYNCRO, 60 Cycle, 110-120 Volt AC. Comes with 9 sheets Aluminum Oxide sandpaper, felt and virgin lambswool pads, 8 ft. cord, plug, only **$14.50**

Ideal Gift For Men and Women!

NEW ELECTRICAL GIFT IDEAS *for* KITCHEN and WORKSHOP!

Presenting the

NEW and ONLY ALL-PURPOSE Electrical HONE SHARPENER

The Gift *any* woman or man will really appreciate! This beautiful new SYNCRO sharpens *not just knives* but hundreds of other articles safely, quickly—by HONING the edge. "Honing" helps preserve edges. 14,400 gentle, rapid HONING strokes a minute! NOTHING ELSE like SYNCRO! No belts, gears or wheels. 60 cycle, 110-120 Volt AC. Insist on genuine SYNCRO—the only electric ALL-PURPOSE HONE Sharpener! Comes with 3 Honing Stones, cord, plug, switch, only **$10.50**

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QUALITY PRODUCTS

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Because SYNCRO HONE SHARPENERS and SANDER-POLISHERS are so new, dealers may not yet have them in stock. If dealer hasn't, order any SYNCRO product direct. Send full amount, we'll ship prepaid! Remember—don't be satisfied with anything but a genuine SYNCRO!

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DEPT. M-119, ROCHESTER, MICHIGAN, U.S.A.

World's Largest Makers of Safe Electric Jig Saws

Christmas GIFT MART

MERRY CHRISTMAS

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SAVE UP TO 85% IN WAR SURPLUS

Palley Clothing BARGAINS

B-15 Style BOMBER JACKET Sturdy, water repellent Mountain Cloth. Body & sleeves fully lined with 100% All Wool Pile. Mouton Fur Collar. Zipper Front & rib knit cuffs & bottom. Has two outside slash pockets.
Sizes: 36 – 46 in O.D. Color only. $10.95
Sizes: 48, 50, 52. . . . . 12.45
Boy's sizes: 6 – 18. . . . . 8.95

Motorcycle Jacket Like the best "custom made" jackets. Top grade Horsehide, zipper opening on sleeves & 3 pockets, 1 snap pocket. Snaps on collar & shoulder straps. Waist belt with large buckle. Body & sleeves fully lined with Rayon-tex. Flannel inner lining. Form fitting waist & action back. Full length zipper closure. Rich Black. Sizes thru 46 . . . $25.95

HORSEHIDE Flight Jacket Smart & stylish. Top grade Horsehide with furry Mouton collar. Has 3 roomy pockets & zipper slash pockets. Knitted wrist & waist band. Fully lined, body & sleeves, with blanket stitched Rayon-tex. Flannel inner lining. Full length zipper closure. Cordovan Brown. Sizes thru 46 . . . . . $23.65

NAVY MELTON COSSACK STYLE JACKET BRAND NEW!! ALL WOOL!! Extra warm & durable. Has 2 slash pockets. Full zipper front closing. Tailored to fit snug for added warmth. Ideal work jacket for farm, factory or outdoor wear. Sizes 40, 42, & 44. . . $5.19

MACKINAW Here's a real outdoor, rough weather garment. Heavy Poplin cover – water repellant, wool blanket lined, thigh length. Sleeve flap adjustment. Full belt, 2 roomy pockets. Just right for the outdoor man, truck & tractor driver, hunter, farmer, etc.
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16 POCKET VEST Sturdy, Yet Light Wt. Satin Lined with Tie Straps, 14 Outside Pockets, Plus Knife, gun, Tool, Leather Holder, 2 large 11" x 8" Pockets Inside, Wonderful Hunting, Fishing, or Mechanic. A Steal at $2.79

FLYING SUIT or Blue Bunny SUIT For hunting, winter sports, skiing or "bundling". As coveralls for cold outdoor, or farm work, 100% woven wool with extra flannel inner lining for double warmth & utility. Wiring so fine, flexible it does not interfere with movement. Can be used with or without heating or can be plugged into car, tractor, or truck battery. Sizes 36 thru 44. . $3.49

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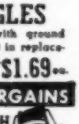

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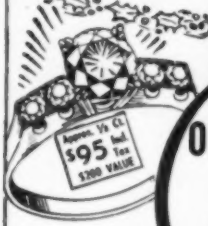

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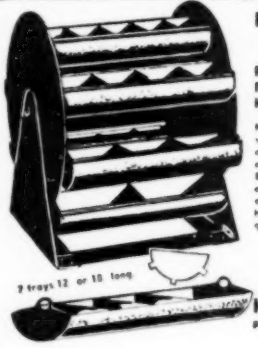

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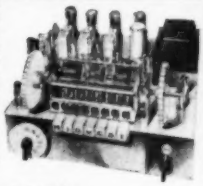

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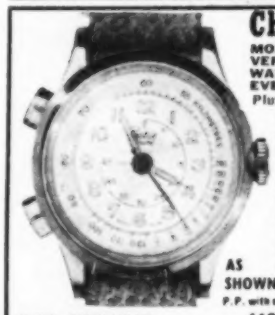

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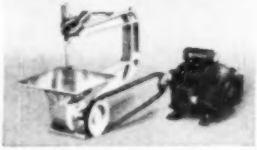

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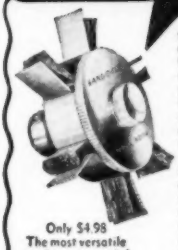

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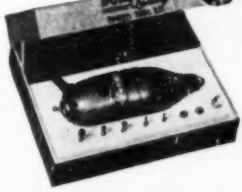

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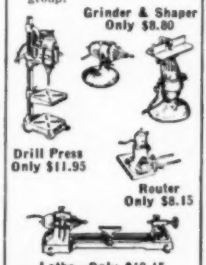
This is the kind of lightweight, perfectly balanced hand power tool that hobbyists and home craftsmen dream about! A compact fistful of super power, it runs cool and smooth at 20,000 RPM, develops 42 watts output. With it, you can do clean, professional-looking sanding, polishing, grinding, engraving, carving . . . and scores of other operations.

Start with this low cost tool kit and build a complete home workshop! One Duro Super Power Unit is used on all of these home workshop tools! You may buy them singly—or in a group.



Ball Bearing Flexible Shaft Doubles the Fun

New Duro flexible shaft fits over nose-piece of power unit, makes free-hand carving, engraving lots more fun. Flexible shaft, complete with hanger, only.....$15.55

Write for Free Illustrated Circular

giving full details about the Duro Super-Power Unit and the low cost workshop units. Circular also shows almost a score of pictures and details about operations that you can do with these amazing power tools.

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2667 N. Kildare Ave., Chicago 39, Ill.
Gentlemen: Send me free circular giving full details on the Duro Super-Power Unit and the low cost workshop units.
Mail Orders Handled Promptly—Shipped Postpaid.

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IN STAINLESS STEEL $1.00

IN GOLD PLATE ON STAINLESS STEEL $1.50

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☐ Stainless Steel @ $1.00 ☐ Gold Plate @ $1.50
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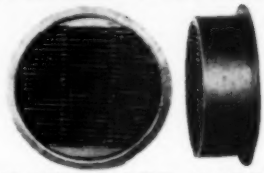
Retailer and Wholesaler Inquires Invited

DARK ROOM VENTILATORS

13½" DIAMETER



4½" THICK • STEEL

VENTILATE YOUR DARKROOM

$25.00 Value—Price $7.50 set or $4.00 Each

New government surplus. Air flows through these steel louvers freely due to the arrangement of baffle plates. Light does not show through these ventilators. Hundreds of these vents have been installed in darkrooms. You will need two for your darkroom. Install one in or near the ceiling and one near the floor. $7.50 for set of two, or $4.00 each.

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$18.95 Postage Paid

¼" capacity in steel, drives wire brushes and many accessories. Fast Jacobs hex-key chuck. Instant release trigger switch. Strong, light die-cast aluminum housing fits hand. 3 wire cord for ground. Low price plus Black and Decker quality. Ideal as a gift.

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Pay by Money Order or Check. 25% dep. on C.O.D.'s. Prices on ventilators are F.O.B. Fresno. Shipping weight 20 lbs. for set of two. POSTAGE PAID ON ALL ELECTRIC HAND TOOLS.

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of FRESNO

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Miracle Plastic Golf Club Covers
Made of heavy blue Vinyl plastic over cotton twill. Attached with raw-hide cord. Yellow flannel numbers. Moisture-proof, scuff-proof—real protection for your woods. Each set boxed as gift. Set of 3—**$2.70**; set of 4—**$3.60**. Postpaid. No C.O.D.'s

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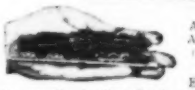

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Have fun building and operating America's smallest railroad models. Accurately scaled 10 ft. = 1 inch. Track (TT gauge) only 15/32" wide.

COMPLETE TRAIN SET KIT WITH ENGINE, 3 CARS, AND 10½ FT. TRACK **$29.95**

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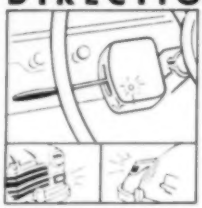

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No more winter window cranking for arm signals. The new SIGNALITE DIRECTION SIGNAL fits any car. **Flashes parking and tail lights** 60-80 times a minute. No interference with regular lights, no extra lights to mount for most late cars. Works similar to factory-installed models. All parts furnished—install it yourself. SPECIFY MAKE AND YEAR. For cars earlier than 1942 write for price. **Money Back Guarantee.**

$12.95 Postpaid in U. S. Send check or money order. Postage extra on C.O.D.'s.

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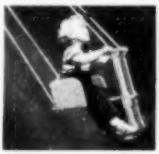

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for Playroom, Porch, Yard, Garage or Basement.

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CHILDREN 2 to 7 LOVE IT!

At last—a safe and sturdy self-propelling swing. It soars thru the air by simply pumping the handle. Keeps kiddies busy and happy—gives years of pleasure. Satin smooth hardwood, clear lacquered. Complete with all bdwe. and ropes. Ready to use in 10 minutes. Instructions furnished.

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C.O.D. $2 plus postage, or send $2 and we pay postage.

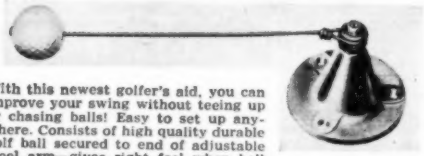
ONLY $2.00

THE IDEAL X-MAS GIFT!

PINE WATCH CO. 29 ELDRIDGE STREET Room 40 N. Y. 2, N. Y.

GOLFERS!

IDEAL CHRISTMAS GIFT!



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Just dial ANY WIDTH CUT ON YOUR SAW!

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Cut clean, accurate, parallel grooves—12 widths, any angle. No chatter, burning, chewing—or sanding! No more blade vibration—no screws to fuss with—just four balanced washers. Simply dial desired width with Micromatic adjustment. Can be left on blade for straight cuts. Available in 5 sizes—½", ¾", ⅝", 1", 1⅛". A perfect gift for woodworkers. See your dealer or write—

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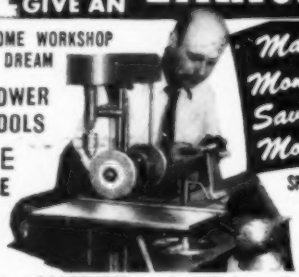
COMPLETE HOME WORKSHOP
HANDYMAN'S DREAM

5 POWER TOOLS IN ONE MACHINE
only $39.95



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- Swiss precision movement
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COMPLETE SHALLOW WATER DIVING KIT

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NOW Only $49.50 F.O.B. Wilmington

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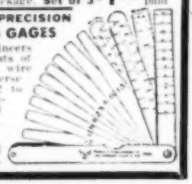
Specially designed for machinists and engineers who want a compact set of gages. Consists of taper gage with 3" rule on reverse side, wire gage with decimal equivalents on reverse side, 9 thickness gage leaves from .002" to 1/16". Overall length is only 4 1/2". List price $5.00 $2.00 Postpaid

Send check, money order or cash. No COD's. Satisfaction guaranteed.



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Make musical stuffed toys, cake plates, cigarette boxes, etc. for Xmas or for Xmas Gifts with our fine imported Music Movements. Single tune units — Mary Had a Little Lamb, Brahms Lullaby, Heigh Ho, Rockabye Baby, Ave Maria, Blue Danube, Anniversary Waltz. $2.25. SPECIAL two tune units playing waltz and operatic selections for five minutes on one winding $3.50. Dealers inquiries Quantity Discounts.

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Broadcasts Over Any Radio within 75 ft.

Here's a fascinating miniature transmitting system that will delight everyone! Practical jokes and dozens of other uses that will astonish one and all! **Clear, Life-like tone. Easy to operate!** Complete with tube, batteries, tuner and built-in high-fidelity microphone. SAVE MONEY! Send check or M.O. We Pay Postage. C.O.D. Plus Postage.

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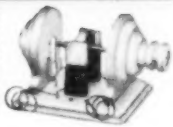
Drives toys from ordinary flashlight batteries. Have fun with this real, powerful electric motor. Easily assembled with your own hands, without tools, screws, bolts, nails or glue. Made of plastic and metal parts. Any child can build it. Drives most any free running toy. No transformer or house current needed. Complete with full instructions. $1.00 postpaid. Money Back Guarantee.



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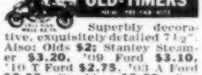
ILLUMINATED PASSENGER STATION— Exceptional Value. All metal 7" x 14" x 5⅝" hi. Realistically detailed with signs and poster. Finished in 5 colors. For "O" and "S" Gauge. **$3.95** p. p.

32 PC. ACCESSORY OUTFIT $2.00

Add detail to your R. R.—16 Tele. poles, 6 Lamps, 4 billboards, 4 crossing gates and 2 trees. "O" and "S" Gauge. Send stamped env. for Lionel circl. or HO TRIX Ready to Run train BROCHURE. Catalog of model books—plans **10c.** 120 p. p. Ship models—fittings **35c.** Everything for hobbyists. VISIT:—

TINY ELEC. MOTOR $1.50 Compact, powerful, reversible. Plastic housing. 1½-4½ V. Perm. Mag. 1" x 1⅜" x 1½" hi. 2 oz. Shaft 3/32 x 2". MULTISPEED GEAR BOX **$2:** — Plastic housing ½ oz. 4 diff. speeds & shafts. 1" wide. Set pulleys, etc. **25c.**



Superbly decorative, exquisitely detailed 7½". Also: Old- **$2:** Stanley Steamer **$3.20.** '09 Ford **$3.10.** '10 T Ford **$2.75.** '03 A Ford **$2.75.** Rambler **$2.60.** Reo **$2.75.** Horseless Carriage **$1.75.**

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MAKES THIEVES RUN

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Sensational Xmas gift! Protects car, contents. Scares thieves away by intermittent horn blasts. Easily installed. 10-yr. factory guarantee!

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What a Watch! What a Buy!
17 JEWELS • 2 PUSH BUTTONS

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A precision instrument. Wrist watch, stop watch, tachometer, telemeter all in one. Sweep-second hand. Radium dial, stainless steel back. Ideal for mechanics, sports, science, medicine, engineering. 10-day money-back guarantee of satisfaction.

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- Water-resistant
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HANDSOME thin-model, expensive-looking, with matching expansion bracelet. Chromed top with stainless-steel back. Incabloc shock-feature found only in more expensive watches. 10-day money-back guarantee of satisfaction.

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ARMY FIELD *Telephones*

Compact . . Rugged . . Portable
Anyone can install and operate

Just hook up terminals of two or more phones to any 2-conductor wire and you are ready to talk **up to 17 miles!** Powered by standard flashlight batteries. **HUNDREDS OF USES** for quick, dependable communication in **HOME, SHOP, FARM, INDUSTRY.** Complete with self-contained hand-operated ringer. **Checked for perfect operation and guaranteed.**

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Two for **$18.50**

LIKE NEW, each phone undergoes thorough performance check in our reconditioning shop to assure peak operating efficiency. Best appearance of handsets and chassis units is restored
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6 phones on one line makes excellent intercom.

TELEPHONE WIRE

Weatherproof, durable, 2-conductor, twisted, communication wire, insulated, stranded 7X.013, reinforced with steel strands for extra tensile strength (3 copper & 4 steel).

W-110B. Unused, new, stored in open. Half-mile reels (2500 to 2750 feet). Wt. 85 lbs. Each.....**$14.25**
ONE-MILE REEL.....**$27.50**
500 ft. coil (14 lbs.).....**$3.95**
1000 ft. coil (28 lbs.).....**$7.25**
NEW W-130 Lightweight. **Half-mile.** (16 lbs.).....**$15.00**

Telephone parts available. WRITE for Free Folder

All prices FOB Sacramento. No COD. California residents add 3% for sales tax. Small orders sent postage collect plus small handling charge.

SEND CHECK OR MONEY ORDER LORIS SALES
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MERRY CHRISTMAS

How Many Leaves on a Tree?

ANY skeptics ambitious enough to count the leaves on a tree may test for themselves an expert's recent estimate. He says a sugar maple 50 feet high, with a trunk of 15-inch diameter, has 162,500 leaves. Their area available for photosynthesis totals 14,930 square feet.

Old Friend Gets New Name

THAT's not a tungsten filament in your incandescent lamp. The name is now *wolfram*, by which this element and metal has been generally known outside the U.S.A. The change, to end confusion, was made by the International Union of Chemistry at a recent meeting in Amsterdam.

Knock, Knock—Who's There?

E. GEOFFREY MONTGOMERY, who lives near San Francisco, was puzzled when he discovered that his radio-operated garage door kept going up and down without command. Finally he tracked down the trouble: United Air Lines transports flying overhead used the same frequency as he did. When the airplane transmitters went into operation, so did the garage doors. Montgomery changed his frequency.

THE IDEAL CHRISTMAS GIFT

DREMEL *Electric* MOTO-TOOL

10 Reasons Why Moto-Tool is a Better Buy

Here's what you get in a Dremel No. 2 Moto-Tool: Oil-less, sealed bearings • Patented automatic chuck lock pin • Oversize armature shaft, hardened, ground, polished • Shockproof, bakelite housing • Dust filtered air cooling system • Dynamically balanced armature (for vibrationless operation) • Exclusive hanger hook • Sturdy 110-120 Volt AC-DC motor • Weight only 13 oz. • Cutters in Kit No. 2 are made of **high speed steel** (not common high carbon steel) for longer life, faster cutting.

Moto-Tools, Kits and Accessories should not be confused with "bargain offers." We invite you to compare Dremel Products feature for feature with other similar equipment. If you are not fully convinced ours are far superior in quality, design and performance, we don't want you to buy.

WIDELY USED IN INDUSTRY—Moto-Tool is a precision-built electric tool, backed by over 13 years of industrial use in such plants as: GENERAL ELECTRIC • FORD • REMINGTON ARMS • NASH-KELVINATOR • WESTINGHOUSE • DOUGLAS AIRCRAFT, etc.

PRE-WAR PRICES STILL PREVAIL

MOTO-TOOL KIT NO. 2 with 23 accessories including **high-speed steel cutters** and Model 2 Moto-Tool in natural finish hardwood case **$23.50**

MOTO-TOOL NO. 2 with one emery wheel point **$16.50**

WHERE TO BUY—Buy Moto-Tool from your dealer. If he cannot supply you, send **check or M.O.** for items desired and we will ship **postpaid.** Or, send only **$2** now and pay postman balance plus postage on delivery. **MONEY-BACK** if not delighted after 5 days' trial. Catalog of Dremel Tools **FREE.**

Dremel Mfg. Co. • Dept. 129-L • Racine, Wis.

Portable

DRILL PRESS

Add all-around versatility to your Moto-Tool with this 12" high drill press. Just the thing for creating costume jewelry, model making, carving, routing, drilling, etc. Utilizes No. 2 Moto-Tool, which can be raised, lowered or swung in any direction. Weighs 3½ lbs.

***Only* $9.95**

(Less Moto-Tool)

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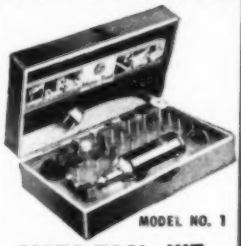

MODEL NO. 1

MOTO-TOOL KIT

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Moto-Tool Kit No. 1 contains the lighter Model No. 1 Moto-Tool and 34 practical accessories (steel cutters, grinding wheels, etc.) in an attractive, lacquer-finish wood case. It's the biggest bargain in the field **$17.50**

MOTO-TOOL NO. 1 with one emery wheel point **$9.85**

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Popular Labor Saver for the HOME and SHOP

Makes play of wax polishing

Soothes tired muscles by massage

The popular Dremel Electric Sander is more than a sander . . . it's also a polisher and massager. This miracle machine is so easy to handle, a child can use it. It delivers 14,400 strokes per minute. **(1) As a sander,** it gets into tight corners, takes the effort out of sanding walls, woodwork, furniture, workshop projects, etc. **Its straightline (non-rotary) action will not burn or scratch surfaces. (2) As a polisher,** it does a professional job on waxed surfaces of cars, furniture, refrigerator cabinets, etc. **(3) As a massager,** it's ideal for tired or sore muscles of the back, legs or arms. Users testify it is more effective than machines made expressly for this purpose.

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Dremel Electric Sander does all the work . . . you merely guide it. It weighs only 2½ lbs.; it's foolproof (has only two moving parts . . . never needs oiling). Quick-change clamps firmly hold abrasives and pads. Dremel Sander is sturdily built to give long, trouble-free service. Operates on 110-120 Volt, 60 Cycle, AC. Thousands and thousands of satisfied users **prove its outstanding value.**

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☐ **Free catalog of Dremel Electric Tools.**

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CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

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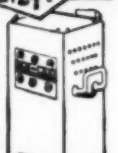

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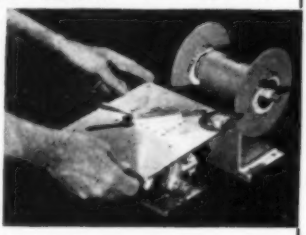

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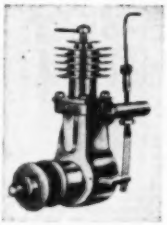

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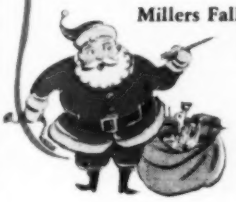

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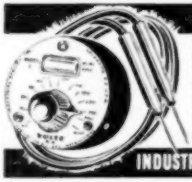

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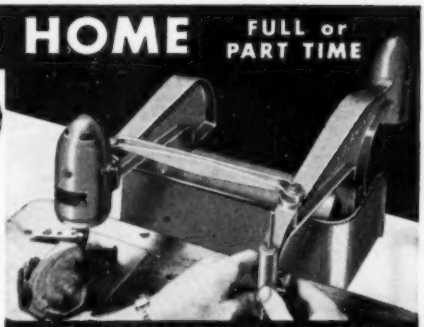

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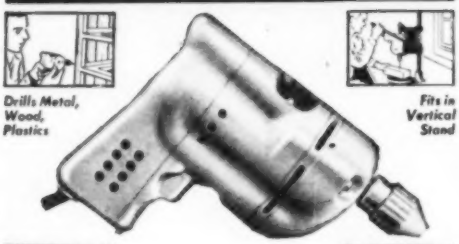

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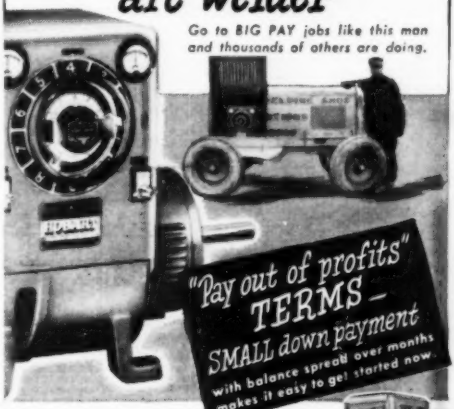

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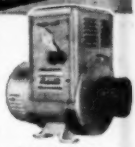

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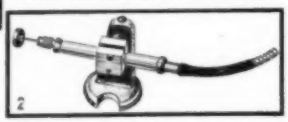

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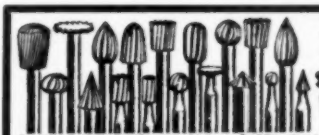

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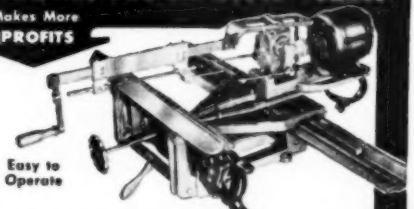

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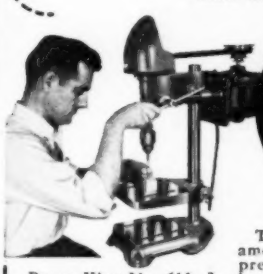

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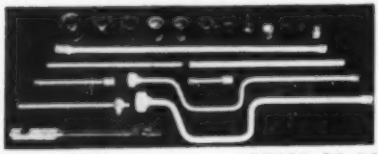

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The great building industry is your profitable market for masonry products. Low investment . . . high returns . . . wide-open opportunity to establish a lifetime business.

The biggest building years in the nation's history are just beginning. New construction, involving billions of dollars, means huge demands for block, drain tile, and other masonry products which YOU can manufacture locally, from local materials with local labor for local consumption. Remember, MASONRY products mesh with today's demands.

Use our modern machines and equipment to insure the finest quality products at pared-to-the-bone manufacturing costs. Sold direct. Backed by 40 years of manufacturing. Write for catalog. Gives prices and full information.

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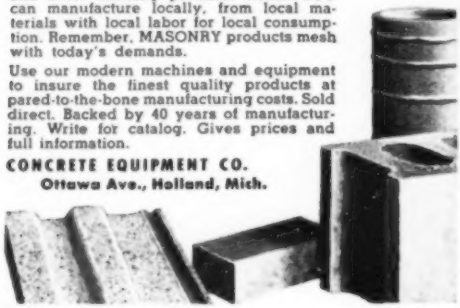

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WORLD'S LOWEST PRICED AUTOMOBILE!

80-90 MI. PER GAL.—45-50 MI. PER HR.

Drive this car for as low as 50c per week. Precision built parts direct from factory with beautiful all steel body. Get all the facts on this amazing small auto—send 25c for detailed circular with large picture, 4 view drawings and price of all parts, or send $1 (refunded first order) for this plus actual assembly book with 42 photos, drawings; blueprints of snow and ice conversions, etc.

King Midget is the ideal small car for errands, sports use, to and from work, short business or pleasure trips, delivery service or second-car utility for the whole family. Comfortable—room for husky six footer.

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Mixed screws & metal screws—30c Lb.
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BARGAIN OFFER ($2.40 value) one lb. each of above 7 mixtures—$1.95
POSTAGE Screwy Mix, Add 5c per lb.
POSTAGE Bearings, Add 10c per order, Minimum order $1.00

Bore	O.D.	Type	Price
5/32"	⅜"	Ball	15c
3/16"	½"	Needle	15c
¼"	⅝"	Needle	15c
¼"	¾"	Ball	22c
5/16"	½"	Needle	15c
⅜"	⅞"	Ball	35c
⅜"	11/16"	Ball	30c
⅝"	13/16"	Ball	40c
¾"	15/16"	Ball	60c
1"	1¼"	Needle	28c

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Streamline, $3.95

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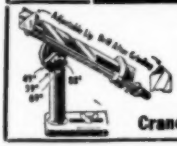

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WITH *Infinitely VARIABLE SPEEDS, Clutch and INSTANT REVERSE*
OUTPUT TORQUE ADJUSTMENT UP TO 180 inch POUNDS

This positive displacement Hydraulic Torque Converter is the ideal fluid drive with thousands of uses. Output Speeds Infinite to 550 R.P.M., in either direction. Change Speeds WHILE RUNNING. Control and Transmit your power this SMOOTH Oil-Way. Will handle ¼ H.P. to 1½ H.P. Motor. Industrial or Home & Farm Use. Cost Government $300. High Quality Precision Workmanship. Buy this unit to get the most for your money. Case measures 7½" long 7" high 6½" wide. Input & Output Shafts ⅝" dia. Beautiful Red Crackle Finish Case.

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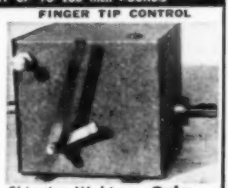

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2 quarts oil included FREE

If C.O.D. is requested a 10% Deposit must accompany order and we ship F.O.B. Chicago.

1½"-8 thread Lathe Chuck Adapter, $3 extra

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FREE! Illustrated folder and price list of castings, milling cutters, etc. Write today. Mention your lathe.

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Equipped with rubber tire metal wheels.

- All parts semi cut
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Here is a steady repeat CASH business you can start at home in your basement or garage, while you are working at your regular job. No experience is necessary to turn out perfect cutting saws —"the first saw I sharpened came out 100%. I think the Foley Saw Filer is a marvel of perfection," writes Clarence E. Parsons. Every saw you sharpen will bring you new customers. You will find you can make up to $2 or $3 an hour—$20 to $30 a week in your spare time as a starter.

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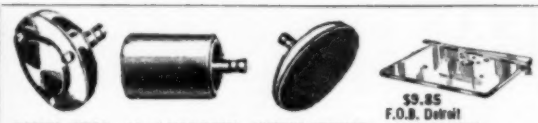
BARRON Drill Press TOOLS



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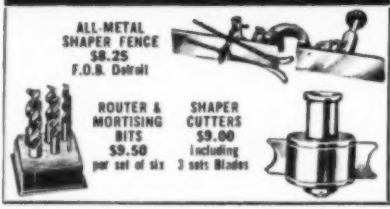

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In your own workshop allows you to design and build your own GASOLINE ENGINES, STEAM ENGINES, STATUARY, ART OBJECTS, SPECIAL TOOLS, NEW INVENTIONS, ETC. You can also make forgings and case harden steel. Your shop is not complete without a FOUNDRYETTE. Three sizes are available capable of making bronze castings of 1½, 3 and 6 pounds weight, aluminum, copper, brass, etc., $22.50, $29.50, $42.00 f.o.b. Kansas City. Domestic gas supply and 110 volt AC or DC energy required for operation. Write for circular.

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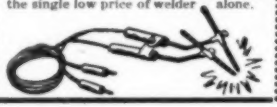

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Send me FREE details of your ELECTRIC Arc Torch Gift Offer and Dynamic Welder 10-Day TRIAL OFFER.

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WESTINGHOUSE AIR COMPRESSOR

2-CYLINDER PISTON TYPE

Operates with 1/2 H.P. Motor or equivalent gas engine.

Complete outfit consisting of compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. Complete outfit of 7 items ..... ONLY

$29.95

SHIPPING WT. 40 LBS.

COMPRESSOR SEPARATELY $21.50

Equipment less compressor ..... **$10.50** Wt. 15 lbs.

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Wherever Compressed Air is Needed

For spraying paints, insecticides, etc.; inflating tires, operating air tools and many more uses. Automatic clutch makes it suitable for mounting and operating from trucks, tractors, etc. Instructions furnished. A fortunate purchase from the government enables us to offer you this amazing buy. All brand new equipment. Replacement parts available.

This low price is but a fraction of the price of manufacturer and of leading mail order houses.

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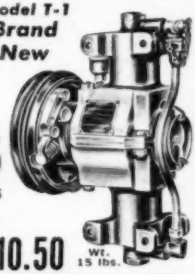

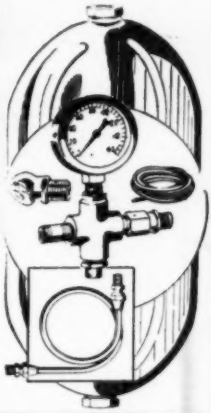

THE COMPRESSOR

Piston Type, 2-cylinder, 2 inch bore, 1 1/2" Stroke Ball Bearing, 3.27 C.F.M. at 600 R.P.M. Capacity up to 6.54 C.F.M. Suggested operating pressure 75 P.S.I. DIMENSIONS: 9" wide, 11 7/8" high, 6 5/8" deep. Wt. 26 lbs.

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6" x 24" stainless steel tank suitable for 150 lb. pressure. Two 1/4" openings. Air gauge, pop valve, air chuck, 20 ft. hose. Copper tubing and fittings as shown. Wt. 15 lbs.

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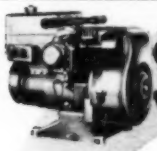

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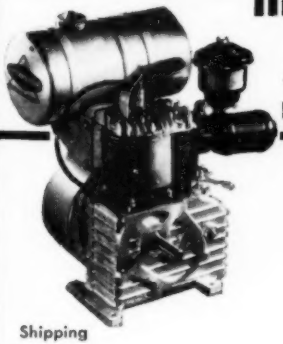

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LESS THAN 1/2 PRICE WHILE THEY LAST

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IN COMPARISON TESTS this engine is efficient, quiet, vibration free, economical to run, and has excellent torque.

BEAUTIFULLY ENGINEERED CAREFULLY INSPECTED

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Shipping Weight **48 lbs.**

Some of the MANY USES for this TERRIFIC ENGINE

Saws	Mowers
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Now! A WATCH THAT DEFIES BREAKAGE

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SHOCK RESISTING
(New Patented Unbreakable Balance Staff)
"CHAMPLAIN ROUGHNECK"
• Drop it! • Shake it! • Jar it!

A handsome rugged stainless steel wrist watch that takes the roughest treatment and still keeps correct time. Ideal for active sportsmen. Luminous dial, genuine leather band. Written guarantee with each watch covers repairs for 1 year. Order today. Satisfaction guaranteed.

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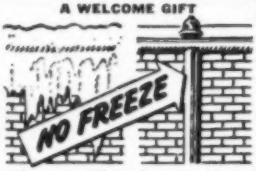

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NO-FREEZE protects your home. It eliminates one of winter's most exasperating problems.

NO-FREEZE guards against the hazards of frozen drain pipes, bursting leaders and hanging icicles. Danger of damage to interior walls and ceilings from ice clogged drains is eliminated.

NO-FREEZE is a sturdy, easily installed brass container with chemicals which dissolve in freezing weather to melt ice and snow. Non-injurious to metals, woods, roofs, or shrubs. One filling normally lasts all winter.

$7.00 Postpaid Money Back Guarantee

For NO-FREEZE Unit with container of chemicals. Refills for subsequent years 75c each—3 for $2.00. West of Miss., add 25c postage for unit and 10c each refill. No C.O.D.'s please.

Write for details
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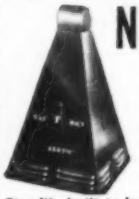

NEW! Trash Disposal Unit Burns Refuse Safely

• A new type outdoor dispose-all unit safely and quickly burns garbage and trash in any weather. All refuse, damp, green or dry is fully consumed. Scientific draft design completely eliminates fire hazard of flying ash, sparks, burning, blowing bits of paper. Intense combustion removes neighbor-annoying nuisance of flying scraps, smoke, smell. Sturdily built to last for years. Nothing to get out of order. Needs no watching. Will not blow over. Will not destroy grass or shrubs. Ends refuse hauling and fire hazards to quickly pay for itself. Measures 23" square at base by 40" high. Weighs 19 lbs. Over 2 bu. capacity. Recommended by Bureaus of Fire Prevention. Full price $9.95—nothing else to buy. Sent F.O.B. Cleveland. Money back guarantee. Send check, cash, or money order to

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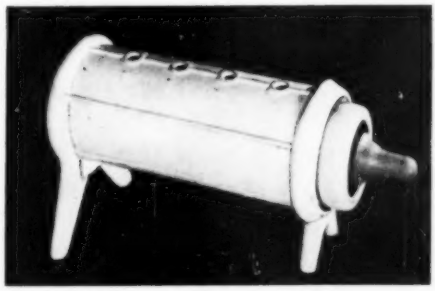

Protects Baby's Bottle. When baby gets the idea of throwing forward passes with his bottle, the Piggie Wiggie® protects it from breakage. It's made of non-toxic rubber and retails for about $1.50 from Rock-A-Bye-Baby Creations, Los Angeles. A slight turn of the bottle locks it in the holder. Soap and water won't harm the rubber.

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Self-Emptying Hamper. Laundry is easy to remove from this Dor-O-Matic® hamper. Pulling it out at the bottom dumps the soiled clothes. The hamper measures 5¼" by 21½" by 22½" high, comes in several colors, and is easily attached to a door or wall. The maker, Pearl-Wick Corp., of New York City, prices it at about $4.

Fireplace Basket Tilts. The two halves of this grate hinge aside for easier removal of ashes. Manufactured by the Stainless Foundry and Engineering Co., Milwaukee, the Tilt-Away® comes in four widths to fit various fireplaces. Prices range from about $10 to $13. It's made of heat-resistant grey iron and is finished in black.

BUILD AN EXTRA ATTIC ROOM

IT'S easy to build an extra bedroom, workroom or playroom in your attic. You can do it quickly, at low cost with GOLD BOND Gypsum Wallboard. The handy panels are fireproof, moisture resistant, and easy to nail in place. Decorate with GOLD BOND Sunflex, the low-cost wall paint that dries in 1 hour. Get both at your local GOLD BOND Lumber and Building Material Dealer today.

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Gentlemen: Send free copy of new Booklet, "Modernizing Magic" showing remodeling ideas and methods:

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HANDY ELECTRIC HOME PAINT SPRAYER

NO BRUSH! NO BACKACHE!

10 DAYS FREE TRIAL

Weighs only 2½ lbs.

Why wear yourself out using old-fashioned brushes? VIBRA-SPRAYER quickly, evenly sprays glossy enamels, lacquers, insecticides satin-smooth. All-in-one instrument requires no compressor, motor or accessories. Piston activated, housed in sturdy plastic. Weighs only 2½ lbs., uses standard replaceable mason jar for paint container. Spray volume is adjustable, fingertip control. AC-110 volts.

FOR PAINTING, SPRAYING, DISINFECTING

Get professional results painting furniture, metal cans, partitions, concrete, brickwork, rough wood, boats, wagons, screens, cabinets, venetian blinds, metal equipment, etc.

Send NO MONEY — 10 Days' Trial

We guarantee that VIBRA-SPRAYER will supply paint smoothly, quickly, easily—or return it within 10 days for full purchase price refund. Only $12.95 C.O.D. plus delivery, or send full payment now and we pay delivery. Order NOW from

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DISHES, FURNITURE, LUGGAGE

It's transparent, waterproof, flexible and durable. Get a tube today.

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VENETIAN BLIND KITS

Save as much as 50%

Assemble your own custom-made Venetian Blinds. Complete Kit takes only a few minutes . . . so simple anyone can assemble it.

NO "EXTRAS" TO BUY! You get beautifully finished aluminum slats, all holes drilled, all hardware, screws, tapes and cord, headpiece, tilt, bottom rail, etc. You need only a hammer and screwdriver. Built for a lifetime of service!

Available only by mail from the largest manufacturer of Venetian Blind Kits. Send for complete information today!

RUSH COUPON NOW!

Flexolite Manufacturing & Supply Co.
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Please send complete information on Flexolite Venetian Blind Kits.

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Removing Paint is no problem now!

Yes, it's easy to remove any type of finish the professional WONDER-PASTE way. There's no arm-tiring work with a torch; no messy sanding needed afterward.

Simply apply WONDER-PASTE directly over the old finish with a paint brush . . . Allow time for complete penetration—then remove with a putty knife. The butter-soft sludge peels off easily, quickly, cleanly! Won't injure wood, metal, fabrics, or your hands.

At paint and hardware stores everywhere.

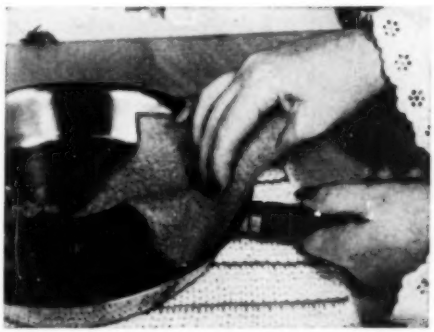
Write for Leaflet

WONDER-PASTE

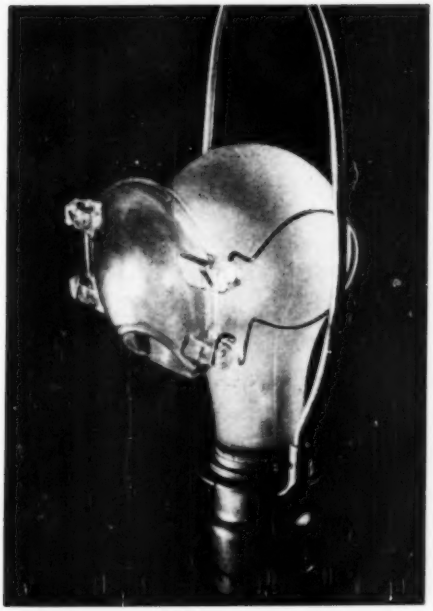
Wilson-Imperial Company, 121 Chestnut Street, Newark 5, N. J.

Aids to Modern Living

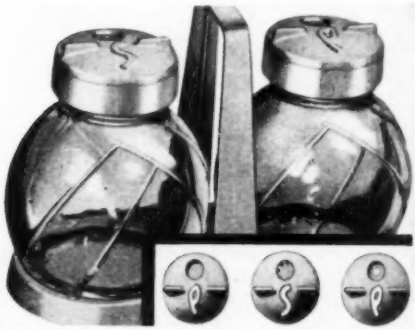
Automatic Lamp Control. The Light Watchman®—the little box at the left of the lamp—turns the light on at dusk and off at dawn. When daylight fades, a photoelectric cell in the box trips a relay, turning on the current. Encased in a steel housing, it measures 3½" by 4" by 5". The maker is Ripley Co., Inc., New York City.



Cloth Coated with Abrasive. A fine, non-metallic abrasive powder on this dishcloth does the job of cleaning pots and pans. The adhesive used to hold the powder to the cloth is unaffected by soap, water, or grease. The cloth can be rinsed and used repeatedly. Metal Textile Corp., Orange, N. J., is the maker.



Clip-On Lens. The Lek-Tro-Lens® throws a large area of light about twice as bright as the illumination obtained from the bulb itself. It fits any bulb from 25 to 100 watts and may be positioned on the side or top of the bulb to throw extra light for close work. It's made by Fairbridge Co., Inc., of Bridgeport, Conn.



Tops Have Three Positions. The two-piece, pivoted caps of this kitchen salt-and-pepper set may be turned to free-stream quantity pouring, standard shaker action, or securely closed. Made by the Federal Tool Corporation, Chicago, the set includes a sturdy plastic tray for easy carrying. The retail price is about 50 cents.

The JIFFY metal CABINET

YOUR ANSWER TO SMALL ITEMS STORAGE
at home, office, and shop
(IDEAL GIFT, TOO)

So handy to keep nuts, bolts, screws, nails, parts, washers, stamps, hobbyists' needs, etc., at your fingertips.

THIS 32 DRAWER UNIT ONLY $5.95 POSTPAID

Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

SPECIFICATIONS	WITH ALUMINUM DRAWERS	WITH CARDBOARD DRAWERS
32 Drawer Unit 6" Deep 12¾" Wide 15¼" High **64 Drawer Unit** 6" Deep 25½" Wide 15¼" High **Drawer Size** 1¼" Deep 2¾" Wide 6" Long	**Dividers and Index Cards Included** One piece rustproof aluminum drawers for heavy service — good for work bench and industry use. **32 drawer - $8.95** **64 drawer - $15.95** POSTAGE PAID	Suitable for most home uses. Heavy board kraft covered. Metal drawer pulls. **32 drawer $5.95** **64 drawer $9.95** POSTAGE PAID

Ohio orders add 3% sales tax.
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Fits all straight engines with "freeze plugs" 1" to 2½" dia. (Except Ford 6, small Jeeps and V-type engines).

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Shipped parcel post prepaid if remittance is enclosed; otherwise COD with postage added.

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INSTALL A
SHUR-HETE No. 5 MOTOR WATER HEATER

Get easy starts and actually save money this winter. How? By installing a Shur-Hete No. 5 — it will keep your engine warm all night long by heating the liquid in the water jacket.

Operates on regular 110V, AC or DC electric current...consumes only 300 watts per hour.

Save Time and Money with Shur-Hete No. 5

Eliminate run-down batteries... towing charges . . . needless engine wear . . . and wasted gas.

Uses about 5 cents worth of electric power for overnight protection.

Safe to use with any standard anti-freeze.

Will not overheat engine or burn out.

Dealerships Open!

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P.S. Last minute news & notes...

WHAT GIVES? Supervisory employes at the East Pittsburgh plant of Westinghouse can get the latest dope by dialing a code number on any handy intra-plant phone. A tape recorder talks off the latest company news and policy.

TV HURT YOUR EYES? It may be a blessing in disguise, says the National Society for the Prevention of Blindness, by getting you to an eye doctor quicker. Difficulty in seeing at low TV levels may make you aware of sight problems sooner than normal conditions.

BOTTLE CAPS won't roll behind the refrigerator when lifted with a new magnetized opener called Magna-Katch. Made of high-carbon steel, it grabs the caps as they come off.

CLAY PIPE is getting its first improvement since man first fired clay thousands of years ago. A glass lining, developed by Texas Vitrified Pipe Co., is fused to the inside only, leaving the ends unglazed for a strong bond.

PENICILLIN cures a lot of things, but it won't keep you from catching cold, according to the results of a scientific test at Kaiser's West Coast plant. Some 3,000 people took part in the test; half got penicillin pills, the other half harmless chalk pills. Nobody but the doctors knew which was which. Incidence of illness in the two groups was just about the same.

KITCHEN TELEVISION has arrived. An all-white job by Motorola to go on the shelf with the flour and sugar. Now Mom can mix a cake step by step with the pictures. But what happens while she is running the mixer and watching a soap opera?

WINNER of the original painting of the August PS cover, as promised in the Voice of Science of that issue, was Loy McGinnis, Friendswood, Texas. The editors assure all PS readers who contributed to the CARE book fund that their Bucks for Brain Food were most welcome.

YOU'LL LIVE LONGER than your father, barring A bombs and week-end motoring. Some 18 years longer than expectancy at the turn of the century; and about twice what the old-timers could hope for back when this nation was founded. That's the mathematical prophecy made in a new book by three statisticians of Metropolitan Life.

The Editors

YOU can find over 100 PRACTICAL USES and have LOTS OF FUN with

5 in 1 Miracle Projector

Electric Enlarger and Copy Maker

Magnify & Project

Stamps, coins, purses, clippings, maps, science specimens, plans, etc. Examine magnified details. Project on paper and sketch copies, larger or small. Easier reading for weak eyes.

Magnifying Reader for Small Detail & Print

Amazingly Useful Invention

Home Fun—Schools—Salesmen—Clubs—Artists—Teachers—Shops—Sign Makers—Doctors—Classroom—Scientists—Students—Money Maker—Photographers—Experiments—Lab workers—Printers—Painters &c., etc., etc.

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Learn to Draw & Sketch Signs, Cartoons, Pictures Easily

Posters, Lettering, Comics, Objects

Project sketches, pictures, objects, etc on drawing paper. Sketch over with pen, pencil, colors, etc. Easy to make any kind of cartoons, drawings, signs, etc either large or small. Make cartoons from pictures. Easy to do: no skill, no practise.

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Copy Any Picture or Object

Project and form it large or small. Make enlargements of plans or drawings. You'll be surprised how many practical and entertaining uses you can make. Advertising posters, cartoon sketches of friends, etc., etc., etc.

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Projecting Microscope Gives Live Show

Put ants, insects, flies & other bugs or animated objects under glass & let them walk around. See them in action greatly enlarged and magnified MOVING on screen. Amazing, real-life scientific motion pictures. Like having a projecting microscope.

projects & enlarges in full natural color; projects reading matter correctly, readable. Clippings, pictures or sketches, color transparencies as well as small objects in brilliant natural colors, brightly lighted up by electric light inside projector.

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Different Show Every Night; No Films to Buy; No More Expense; Sports, Girl Beauties, Comics, Etc. Your favorite SPORTS, MOVIE or COMIC PICTURES from papers & magazines. Enlarge action pictures. Project snapshots of your girl, family trip. Project and read comic strips to kids. Large pictures projected in full color!

Educational, Scientific; Real Life Action! Live ants, flies, bugs and small animals can be projected on screen; watch them in real life action, fighting, eating, playing. Great for amateur scientist experimenter and camera fan.

Make Signs, Sketches, Posters, Cartoons, Lettering, Etc. Quick! Easy! In Black & White or Full Color; From Clippings or Copy; Large or Small Make sketch or cartoon of friends. Posters and signs for clubs, stores, dances. Easy to make, large or small. Project picture or rough sketch right on blank drawing paper. Using pen, pencil or colors, sketch OVER PROJECTED PICTURE. Project photos and make funny, life-like cartoons or sketches. Amazing & practical. Be a good artist, even though you never did it before! Lettering and signs easy to do.

Magnifies Stamps, Specimens, Objects for Close Examination; Reader for Weak Eyes Collectors can enlarge objects. Examine in greatly magnified detail. MAGNIFIES ABOUT 50 AREAS. Make photo enlargements direct from objects! Enlarges small type, maps, etc., projecting it for easy reading.

Make Photo Enlargements and Copies Without Negatives!

Use Any Photo or Picture

Direct positive photo enlargements and prints without negatives using Eastman direct positive paper. Use any black & white or color picture, colored transparency, etc. Easy to do; excellent results. No complicated dark room equipment. Makes correct copy (same as original), large or small. Also useful for making copies of important papers, plans, documents, stamps, sketches, maps, etc., etc. EASY, FUN, USEFUL, PROFITABLE.

Photo Enlarger; Makes Photo Prints, Photo Copies, Etc.—No Negatives Uses Eastman direct positive paper. Correct true-image photos, large or small, from any photo; or even from color prints & color transparencies. Photo enlargements, copies, etc., done cheaply, quickly, easily. 8x10-in. enlargement costs 12c; sell up to $1.00. NO NEGATIVES. Made by projecting picture on direct positive printing paper. Duplicate copies of blueprints, diagrams, papers; large or small.

3-Dimension Stereoscopic Pictures By special process you can project 3-dimensional pictures and see in startling, life-like realism. So real you expect to reach out and touch them! Project beautiful girl pictures, travel scenes, etc.

No Skill—No Experience—Fun All Year Round Low-priced instrument that quickly pays for itself. No experience and no skill to operate. Just plug into any 110-volt AC-DC standard home socket. Years of entertainment and practical uses for every member of the family. Lasts indefinitely; nothing to wear out, so only cost is low price of MIRACLE PROJECTOR. Schools, shops, offices, artists, etc., all find many uses for it.

Project on Table, Wall or Ceiling—No Screen Necessary Project almost anywhere —even on table. No screen necessary—any blank wall or white paper will do. Wonderful for classroom, clubs and salesmen.

Electric, Optically Ground Double Lens, Enameled Steel Construction Complete except for lamp bulb; use any household 60 to 100 watt lamp bulb. Steel construction, handsomely enameled in brilliant colors. Easy carrying; 7½-in. high, 10-in. long. Optically ground and polished lenses; slide focusing so you can PROJECT FROM VARIOUS DISTANCES to make picture large or small. Takes pictures up to 3¼x4-inches. With illustrated instruction booklet, views, price list for additional supplies, etc. (3 for $10.50). COMPLETE, POSTPAID, CASH PRICE ONLY..... **$3.98**

Picture Enlarger and Projector

Project 3-Dimension Pictures

Put on your own show by projecting snapshots, pictures, post cards, photos, comics, clippings, etc. on wall or screen. Fine for school, clubs, talks, home shows, telling about your trip, salesmen, etc. Full color, correct projection, entirely readable & correct. Special device enables you to project real 3-dimension or stereoscopic pictures. Startling, life-like.

Make Money—Machine Pays for Itself

Many ways to make money. Make photo enlargements, photo copies, give shows, make sketches and drawings and advertising signs, etc. Easy to do—the machine does the work.

What Users Say: Artist & Signmaker: "Valuable and enables anyone to do all kinds of art work without training." Photographer: "Many uses, money maker and fun." Collector: "Magnifies & illuminates specimens for close study." Teacher & Lecturer: "Makes talks ten times more interesting. Teaches faster, more

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(Since 1914 America's Leading Novelty House; Big 500 page Catalog of 7,000 Novelties 10c)

Rush....Projectors at $3.98 each, postpaid; 3 for $10.50.

Enclosed is $.....

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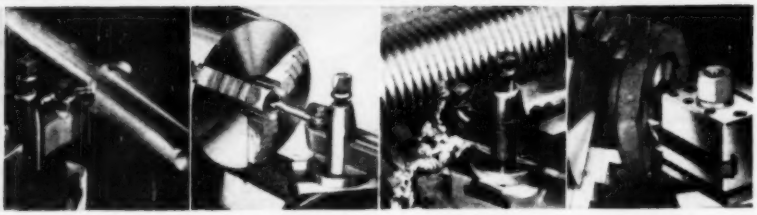
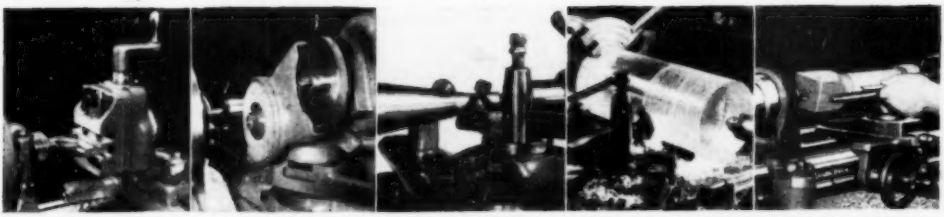


TURNING BORING THREADING FACING



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With a South Bend Lathe as the basic tool in your shop, greater value for each dollar invested is assured. Write today for catalog —please mention the size lathe you require; 9", 10", 13", 14½", 16" or 16/24" swing.

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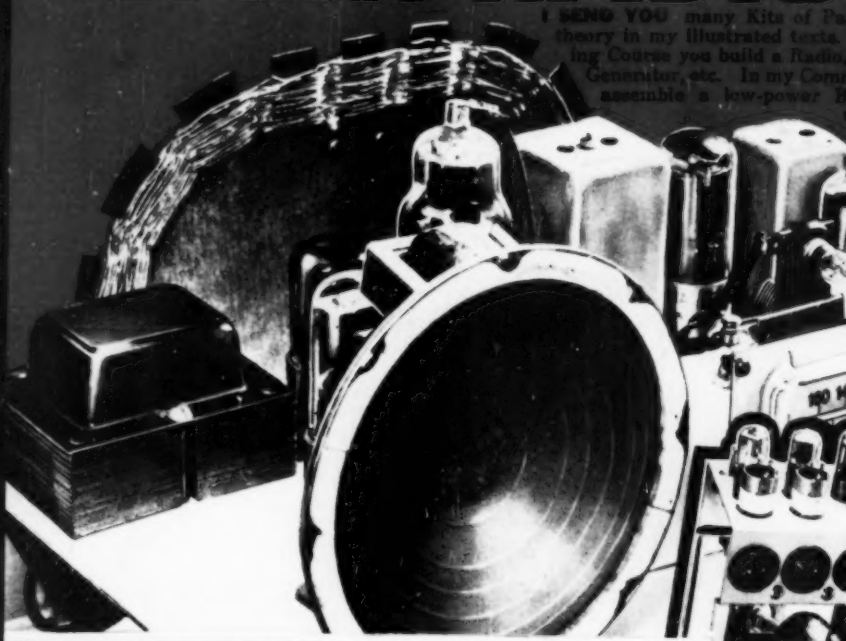

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"I am operating a Radio Sales and Service business. With Frequency Modulation and Television in the offing, we have a very profitable future."—Albert Patrick, Tampa, Florida.

"Am tied in with two Television outfits, and do warranty work for dealers. Fall back on N.R.I. text books often for helpful information." — Robert Dohmen, New Prague, Minnesota.

"Four years ago, I was a bookkeeper with a hand-to-mouth salary. Now I am a Radio Engineer with key station of the ABC network." — Norman H. Ward, Ridgefield Park, New Jersey.

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"N.R.I. was my 'stepping stone' from a few hundred dollars to over $4,000 a year as a Radio Engineer. Make extra money servicing Radios." — A. B. Michaels, Trenton, Georgia.

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"I received my 2nd Class Radiotelegraph License and worked on ships. Now control operator, WEAN, and have 1st Class Telegraph License."—R. D. Arnold, Rumford, Rhode Island.

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Do you want a good pay job in the fast growing RADIO-TELEVISION Industry? Want your own money-making Radio-Television Shop? Here is your opportunity. I've trained hundreds of men to be successful Technicians, MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved train-at-home method makes learning easy. You learn Radio-Television principles from my illustrated lessons. You get practical experience building, testing and experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

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In 1945, there were 943 Radio Stations. Today, about 2700 are on the air! RESULT—THOUSANDS OF QUALIFIED MEN STEPPED INTO GOOD JOBS. Another example—only 19 Television stations were on the air in 1947. Today, more than fifty. Within a few months, 150, say the experts—and 1000 within three years. Then add developments in FM, Two Way Radio, Police, Marine, Aviation, Microwave Relay Radio. Think what this means! New jobs, more jobs for qualified men. The man who prepares NOW can reap rich rewards in this changing, developing, fast growing field!

Act Now! Cut out and mail post card to J. E. SMITH, President, Dept. 9MP3, National Radio Institute, Pioneer Home Study Radio School, Washington 9, D. C.

Make $5,
Spare Time

Many of my s
fixing Radios
while learning
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show how you
I send you p
TESTER that

VETERANS GET THIS TRAINING WITHOUT COST UNDER G. I. BILL **SEND**

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Parts that "bring to life" ...ts. As part of my Servic... ...adio, Set Tester, AM Signal ...Communications Course, you ...r Broadcasting Transmitter, Wavemeter, Electronic Multitester, etc. Keep all equipment you build (some from both courses shown below).

I Will Train You at Home in Your Spare Time FOR SUCCESS IN AMERICA'S FAST GROWING INDUSTRY

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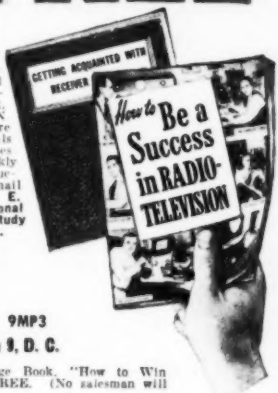

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Be a RADIO-TELEVISION Technician

TRAIN AT HOME IN SPARE TIME

You learn by practicing with Many Kits I send. You build your own powerful Radio, Set Tester, etc. Make $5, $10 a week EXTRA fixing Radios in spare time while learning. Mail card now, get actual Radio Lesson and 64-page book, "How to Be a Success in RADIO-TELEVISION."

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One shot lasts all winter
anti-freeze in your car... and

One shot lasts

Give your car the sam
protection that fire
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You know your car won't freeze up when you need it most!

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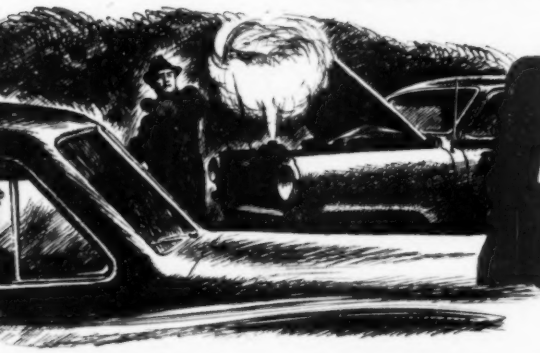

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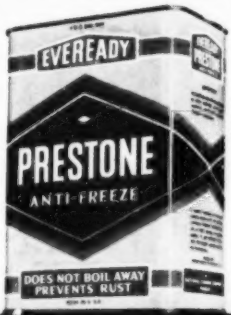
freeze, America's Num- is made to an exclusive fter year, more motor- "Prestone" brand anti- e, all-winter protection.



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NO FREEZE · NO FAILURE

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Ask your dealer to show you the guarantee. It's your assurance of all-winter safety.

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